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CONTENTS:

The Sixth Annual Meeting of the Society of American Bacteriologists: PROFESSOR FREDERIC P. GORHAM 481

The Society for Plant Morphology and Physiology: PROFESSOR W. F. GANONG 498

Scientific Books:—
Hess on Glaciers: DR. HARRY FIELDING REID. *Fry on Varnishes of the Italian Violin Makers:* PROFESSOR A. H. GILL 507

Scientific Journals and Articles 509

Societies and Academies:—
The American Mathematical Society: PROFESSOR F. N. COLE. *The New York Academy of Sciences, Section of Geology and Mineralogy:* PROFESSOR A. W. GRABAU. *The Torrey Botanical Club:* EDWARD BERRY. *The Philosophical Society of Washington:* CHARLES K. WEAD. *The Conference of Neurology and Vertebrate Zoology of Cornell University:* PROFESSOR BURT G. WILDER. *The American Chemical Society, Northeastern Section:* PROFESSOR ARTHUR M. COMEY 510

Discussion and Correspondence:—
Literary Production above Forty: DR. CLYDE FURST. *Production and the Modern Use of Carbonic Acid:* A. BEMENT. *Mont Pélée:* PROFESSOR HARRIS HAWTHORNE WILDER 513

Special Articles:—
Natural Mounds or 'Hog-wallows': PROFESSOR J. C. BRANNER 514

Notes on the History of Natural Science:—
Oppian on Fishes; Roman Ichthyology; Subterranean Fishes: DR. C. R. EASTMAN. 516

Scientific Notes and News 517

University and Educational News 520

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE SIXTH ANNUAL MEETING OF THE SOCIETY OF AMERICAN BACTERIOLOGISTS.

THE sixth annual meeting of the Society of American Bacteriologists was held at the Laboratory of Hygiene, University of Pennsylvania, Philadelphia, Pa., on December 27 and 28, 1904.

The opening address was by President F. G. Novy, of the University of Michigan, on 'The Hematozoa of Birds.'

On the Hematozoa of Birds: F. G. NOVY, University of Michigan.

An abstract or partial summary of the results obtained in this study appeared in *American Medicine,* November 26, 1904. The work in full will come out in two papers, the first of which, dealing with the Trypanosomes in birds, will appear in the second number (1905) of the *Journal of Infectious Diseases;* the second paper, dealing with the Cytozoa, may be expected in the third number of that journal.

The Effect of Freezing on Bacteria: ERWIN F. SMITH and DEANE B. SWINGLE, U. S. Department of Agriculture.

More than 100 freezings were made using about a dozen different bacteria—saprophytes and plant and animal pathogenic forms. Quantitative determinations were made in all cases. With the exception of *Bacillus radicicola,* all of the exposures were made in +15 peptonized beef bouillon, using cultures 24 to 48 hours old. Part of the freezings were made in liquid air, the time of exposure varying from 10 minutes to 24 hours, but usually one half hour. The rest were made in salt

and pounded ice, the time of exposure being 2 hours. The freezings were made in 5 c.c. portions of bouillon in test-tubes of resistant glass. The thawings were made in tap water at 16° to 18° C. The inoculations for each set of plates were made in the same way, *i. e.*, usually with the thinnest meniscus it was possible to obtain across a 1-mm. platinum oese. The petri dishes were carefully selected, those taken being approximately 9 cm. in diameter, with flat bottoms. The regular method of work was to make three poured plates (checks) from the inoculated tubes after insuring thorough diffusion, which was obtained by stirring with the platinum rod, shaking and allowing to stand one half hour. The tube was then immediately lowered into the liquid air and frozen slowly from the bottom up to avoid cracking. (This usually required four minutes.) As soon as the one half hour or other predetermined time of exposure had elapsed, the tube was removed, warmed for about 3 minutes in the laboratory air and then thawed in water. (which usually required another 5 minutes). As soon as the thawing was completed, three more poured plates were made, and these together with the three check plates were then incubated in the dark at 30° C., until the colonies were in good condition for counting—a period varying, according to the species, from one to several days. The plates were all put on a leveling apparatus as soon as poured, and in general the distribution of the colonies in the nutrient agar was very uniform. When the plates were sown thin enough, the entire surface was counted (60 sq. cm.); for the thicker sowings the average of 10 or 12 sq. cm. was used, or of one half the plate. The following samples from two of the thirty or more slides exhibited will give a general idea of the method and results:

BACILLUS TYPHOSUS. (SIX POURED PLATES.)

Colonies per Square Centimeter:

	Before Freezing.	After Freezing (2 hrs. in Salt and Ice).
Plate I.	46	2/60
Plate II.	39	0
Plate III.	42	2/60
Average	42	1/45

Per cent. killed, 99.5.

Frozen, Dec. 15. Incubated at 30° C. Counted, Dec. 19.

BACILLUS TYPHOSUS. (SIX POURED PLATES.)

Check on Salt and Ice, *i. e.*, 1/2 of Same Culture.

Colonies per Square Centimeter:

	Before Freezing.	After Freezing (2 hrs. in Liquid Air).
Plate I.	50	1/60
Plate II.	51	3/60
Plate III.	43	2/60
Average	48	2/60

Per cent. killed, 99.3.

Frozen, Dec. 15. Incubated at 30° C. Counted, Dec. 19.

The following conclusions may be drawn: (1) The effect of very low temperatures has been greatly overestimated. As destructive results were obtained with salt and pounded ice (—17°.8 C., or less) as with liquid air. (2) The critical point appears to be somewhere around 0° C. If an organism can pass this point in safety, it is believed that even absolute zero (—273° C.) would not harm it. (3) Some individuals of each culture were able to endure unharmed the temperature of liquid air (—190° C.), although this was often only a small proportion of the whole number. (4) Repeated freezings and thawings reduced this number very gradually to nothing, but ten freezings and thawing (in course of eight hours) did not kill all of the individuals of *P. campestris*, although it reduced the number in the bouillon to such an extent that three one-millimeter loops gave three sterile plates. (5) This resistance to freezing is believed to be due

to absence of water in the resistant cells, these cells behaving like endospores, although not known to be endospores (*i. e.*, from species not known to produce endospores). Possibly these resistant cells are to be considered as arthrospores. (6) Endospores freed from non-sporiferous vegetative cells by heating in the water-bath for fifteen minutes at 70° C. were not in any way injured by freezing (two species), and this would seem to be an added proof that the protoplasm of such spores is destitute of water, a conclusion already reached by various observers on account of their behavior in boiling water and streaming steam.

So far as any general inference can be drawn from experiments made only in bouillon, we may conclude that bacteria are injured by freezing to very different degrees, behaving in this respect like the higher plants and animals. Many kinds, like *Bacillus typhosus*, are destroyed in great numbers even by short freezings, while other forms, like *Bacillus sorghi*, are rather resistant. The former idea that bacteria in general are not harmed by freezing is untenable. It was based on qualitative tests which are incapable of showing the true state of affairs in the exposed culture. Probably an enormous number of bacteria are destroyed by every winter, and those which survive come through in the form of endospores or some other resistant shape. These experiments confirm and extend those of Prudden, Park and Sedgwick and Winslow. They will be repeated, freezing in water, and will be extended to include some additional species, and will probably be published by the U. S. Department of Agriculture.

The Viability of B. Dysenteriæ Shiga: W. D. FROST and R. WHITMAN, University of Wisconsin.

Four strains of this organism were tested. One was the Shiga type. The others belonged to the Flexner-Harris type. Of these one was the Harris culture and the others were from Duval and Bassett's series of summer diarrhœa cases. The viability was tested by drying the organisms on articles of merchandise, dried food substances and in sterile distilled water and milk, under various conditions. A summary of the conclusions reached follows: the *B. dysenteriæ* when dried on articles of merchandise, as paper, cloth and wood, dies rapidly in from four to nine days at the temperature of 17–20° C. On dried food substances, as bread, rice and albumin balls, this germ may live for days. In some cases it is able to live over a month. In sterile distilled water the life of the germ is very short, rarely maintaining itself more than a week. In sterile milk the germ can live until the medium is dried up. The different strains vary in their viability under given conditions, the Shiga type culture being distinctly more frail than cultures of the Flexner-Harris type, the effect of temperature in modifying the viability of the germ being important. At a temperature of 38° C. it will live from only one half to one fourth of the time that it will live at a temperature of 17–20° C.

Pseudomonas Campestris (Pam.) Smith: H. A. HARDING and M. J. PRUCHA, Experiment Station, Geneva, N. Y.

Pseudomonas campestris (Pam.) Smith is a yellow non-spore-forming plant parasite. It attacks cabbage, cauliflower and allied plants by way of their fibrovascular system.

A study of its resistance to desiccation showed that while it died when exposed on sterile cover-slips for a few days (in our experiments not surviving a ten-day exposure), it retained its vitality on cabbage seed for more than a year. Apparently

no loss of pathogenicity resulted from this long exposure to unfavorable conditions. Cabbage plants inoculated with pure cultures, obtained from seed thirteen months after infection, showed a blackening of the veinlets in the leaf and other evidences of disease at the end of sixteen days.

At a time when so much stress is being laid upon the quickness with which pathogenic organisms are destroyed in nature these observations should tend to check hasty generalizations. (To be published in full in *Centralbl. f. Bakteriol.*, etc., II. Abt.)

The Demonstration of the Flagella of Motile Bacteria and a Simple Method of Making Photomicrographs: Edward W. Duckwall, Aspinwall, Pa.

I found that the methods for flagella staining described by the old authors had to be modified. I divided the motile bacteria into six classes for staining purposes:

1. Bacilli which grow like typhoid, such as typhoid and colon. Bacteria resembling typhoid are actively motile bacteria. The material is transferred to a large drop or two of distilled water, previously boiled. A fine platinum loop, about half the usual size, should be used. The finest specimens of bacteria will swim to the outer edges of the water.

2. Bacilli which produce wrinkled or folded growths, such as *Mesentericus fuscus*. In order to get a good preparation from the bacteria which produce wrinkled or folded growths the agar should be streaked in the morning and carefully watched for the first appearance of growth.

3. Bacilli which send out a thin, almost transparent growth over the surface of the agar, such as *Bacillus subtilis* and *Bacillus megatherium*. In order to get a good preparation from the thin, transparent, spreading growth a curved platinum wire is used to collect the bacteria *en masse* and transfers are made to the distilled water with the small loop.

4. Bacilli which produce slime, such as *Bacillus vulgatus* and *Bacillus viscosus*. The slime which collects between the flagella of the slime-producing bacteria can be precipitated by shaking a water suspension with chloroform. A very young growth is used and transfers are made to about 1 c.c. of water until it is made very cloudy. This suspension is then shaken with chloroform and the cover-glass preparation is made from the water above the chloroform.

5. Bacilli which produce pigments, such as *Bacillus prodigiosus* and *Bacillus cyanogenes*. Bacteria which produce pigments soluble in chloroform are treated in the same manner. Those whose pigments are soluble in water and not in chloroform I prepare by holding the cover-glass under the tap after fixing the preparation in the flame previous to adding the mordant.

6. Anaerobic bacteria, such as *Bacillus tetanus*, œdema and symptomatic anthrax, etc. The best results with anaerobic bacteria are obtained as follows: The medium is two per cent. glucose agar in slants and the inoculation is made back of the slant between the agar and the wall of the tube. I slide the needle back of the slant and let it fall forward, I introduce two or three drops of a young bouillon culture and replace the agar. By excluding oxygen and maintaining a blood temperature for thirty-six hours a fine growth is usually obtained.

I prefer the No. 1 round cover-glasses. For removing the grease they are covered with sulphuric acid, which is poured off after they have stood one day, and they are then covered with bichromate of potassium. After several hours this is poured off and they are washed with distilled water and transferred to a jar containing absolute alcohol, where they remain until

ready for use. A single cover-glass is removed with clean forceps from the alcohol and dried with clean linen without touching it with the fingers. It is then taken in the forceps and passed several times through the Bunsen flame.

The fixing agent is a mordant and the stain is carbol gentian violet or preferably carbol fuchsine.

Mordant.—2 grams tannic acid; 5 grams cold saturated solution ferrous sulphate (aqueous); 15 c.c. distilled water; 1 c.c. saturated alcoholic solution of fuchsine.

To these ingredients I add a one per cent. solution of sodium hydroxid, from .5 to 1 c.c. After filtering, the mordant should be of a reddish-brown hue, and it must be used within five hours after it is made.

Carbol Fuchsine.—Put about one gram of granulated fuchsine in a bottle and pour over it 25 c.c. of warm alcohol; shake, let stand for several hours, and dilute four or five times with a five per cent. solution of carbolic acid.

A small loop full of the clouded water is transferred to the cover-glass. A spread consisting of several parallel streaks is best. The glass, held by the forceps, preparation side up, is passed down on to the Bunsen flame and instantly removed. The mordant is then poured on, just enough to cover the surface without flowing over the edges. After one half to one minute the mordant is completely washed off under the tap; a small quantity of alcohol is then poured on to the surface and instantly washed off. Then cover the surface with carbol fuchsine or carbol gentian violet, which is allowed to stand on the cover-glass for about one half minute. We then heat it so that steam is given off and, after drying thoroughly, treat with xylol, immediately draw off the xylol with filter paper, drive off what remains with heat and mount in xylol balsam.

A Simple Method of Making Photomicrographs.—The camera is about twice as long as the ordinary 4 x 5 camera, and the photomicrographs are taken with the camera in a horizontal position. It must be steady and the microscope stand should be substantial, with the fine cone adjustment. Much depends upon the objective. I have found none equal to the one-twelfth oil immersion objective and No. 6 compensating eye-piece made by the Spencer Lens Co. The best plates are the isochromatic or orthrochromatic swift plates which are corrected for colors. I have found the acetylene radiant preferable to gas, oil or electric light. The only screen I ever use is green glass. Printing from the negatives on glossy Velox brings out the best detail. The glossy Velox is then ferro-plated, which makes a beautiful photograph.

(Complete paper will be published in the *New York Medical Journal;* also in the *Canner and Dried Fruit Packer,* 1905, XX., No. 5, p. 23, with many illustrations.)

Principles of Classification of Bacteria: F. D. CHESTER, Delaware Agricultural College.

As far as possible morphologic characters should be the primary basis of classification. The generic system of *Migula* is proposed, based upon character of flagellation.

With sporogenous bacteria, character of spores, mode of germination, form of sporangia, and orientation of the cellular elements are useful toxonomically. With the asporogeneous bacteria grouping must be based largely upon physiological characters.

The proposed division of genera into groups is based upon leading characters in the order named: (1) Spore formation, (2) relation to oxygen, (3) liquefaction of gelatin, (4) fermentation of lactose, (5) fermentation of dextrose, (6) fermentation

of saccharose, (7) reduction of nitrates, and (8) chromogenesis.

Any combination of the above-named characters gives a character complex which can be best represented by a series of digits. Each digit represents a character in order of value. When the character covered by a digit is either positive or negative two numbers only are necessary, *i. e.*, 1 and 2, 1 signifying positive and 2 negative. Thus spore formation and non-spore formation by 1 and 2 in the hundreds place; aerobic-facultative anaerobic and anaerobic by 1 and 2 in the tens place, and liquefaction and non-liquefaction of gelatin in the units place represented by 1 and 2. In the tenths, hundredths and thousandths place of decimals three numbers are used, in which 1 represents acid with gas and 2 acid without gas, while 3 no acid from dextrose, lactose and saccharose respectively, 1 and 2 in the next place indicate reduction and non-reduction of nitrates, and in the next place numbers from 0 to 8 indicate the absence or the presence of chromogenesis in the order of the occurrence of the colors in the spectrum, namely, 0, non-chromogenic; 1, fluorescence; 2, violet; 3, blue; 4, green; 5, yellow; 6, orange; 7, red; 8, brown; on this basis the number for *B. coli* is 212.11110, for *B. enteritidis* 212.13310.

A Revision of the Coccaceæ: C.-E. A. Winslow and Anne F. Rogers, Massachusetts Institute of Technology.

Since the swamping of minor differences by sexual reproduction is absent among bacteria, every inheritable variation is maintained, and instead of true species we find an infinite series of minutely differing but constant races. The only practical method of handling and systematizing these is to establish certain fairly distinct groups or types about which the lesser individual variations may be grouped. The larger number of published descriptions of species among the cocci are based either on variable or on isolated and unimportant characters. The authors find that 445 described species may be condensed to 31. These are grouped under two subfamilies and five genera which mark transition stages between strictly parasitic pairs of cells like *D. Weichselbaumii* and strictly saprophytic organisms in large vegetative masses like *Ascococcus mesenteroides*. The principal groups are defined as follows:

FAMILY COCCACEÆ.

Vegetative cells spherical.

Subfamily I. Paracoccaceæ (new subfamily).

Parasites (thriving only or best on or in the animal body). Thrive well under anaerobic conditions. Many forms fail to grow on artificial media, none produces abundant surface growth. Planes of fission generally parallel producing pairs or short or long chains.

Genus 1. *Diplococcus* (Weichselbaum).

Strict parasites. Not growing or growing very poorly, on artificial media. Cells normally in pairs, surrounded by a capsule.

Genus 2. *Streptococcus* (Billroth).

Parasites. Cells normally in short or long chains (under unfavorable cultural conditions, sometimes in pairs and small groups, never in large groups or packets). On agar streak, effused translucent growth often with isolated colonies. In stab culture, little surface growth. Ferment sugars with formation of acid.

Subfamily II. Metacoccaceæ (new subfamily).

Facultative parasites or saprophytes. Thrive best under aerobic conditions. Grow well on artificial media, producing abundant surface growths. Planes of fission often at right angles; cells aggregated in groups, packets or zooglea masses.

Genus 3. *Micrococcus* (Hallier) Cohn.

Facultative parasites or saprophytes. Cells in plates or irregular masses (never in long chains or packets). Acid production variable.

Genus 4. *Sarcina* (Goodsir).

Saphrophytes or facultative parasites. Division under favorable conditions, in three planes, producing regular packets. Generally fail to produce acid by fermentation of sugars.

Genus 5. *Ascococcus* (Cohn).

Generally saphrophytic cells imbedded in large irregularly lobed masses of zooglea. In presence of carbohydrates usually form acid.

Full paper (preliminary) to be published in SCIENCE.

Diagnostic Value of the Red Color which Develops on the Addition of Caustic Soda to Solutions of Glucose after Fermentation: WM. R. COPELAND and PERKINS BOYNTON, Columbus, Ohio.

Certain members of the colon group of bacteria produce a substance in glucose solutions which, on the addition of caustic soda (NaOH), forms a brick-red color if the alkali is kept in contact with the fermented bouillon for twenty-four hours.

The glucose solution used in making this test contains:

Meat extract from fresh round beef steak	1,000 c.c.
Peptone—Witte's best white, dry.....	10 gms.
Table salt	5 gms.
Anhydrous glucose	10 gms.
Reaction (referred to phenol-phthalein) .	1% acid.

The caustic soda used contains 20 grams of the best grade of NaOH in sticks dissolved in 1,000 c.c. water.

The fermentation is carried on by the bacteria for a period of 48 hours at a temperature of 37° C. +. The bacillus which brings about the formation of the red color resembles the *Bacillus cloaceæ* of Jordan and the *Bacillus Zeæ* of Moore.

The bacterium described by Dr. Theobald Smith as the typical '*Bacillus coli communis*' forms reactions which differ markedly in every instance from the reactions produced by *B. cloaceæ*. Therefore, as the colon bacillus never produces the red color in glucose solutions and as *B. cloaceæ* does, the appearance of a strong brick red color in a glucose fermentation tube, to which a two per cent. NaOH solution has been added and allowed to digest for 24 hours, may be taken as evidence that the bacteria in the Smith tube are *B. cloaceæ* and are not *B. coli communis*.

I., *The Value of the Widal Reaction for the Diagnosis of Hog Cholera.* II., *The Production of Agglutinins for Hog Cholera Bacilli in Swine:* CHAS T. MCCLINTOCK, CHAS. M. BOXMEYER and J. J. SIFFER, Detroit, Mich.

1. The serum of normal hogs agglutinates strains of ordinary hog cholera bacilli in dilutions occasionally as high as 1–250. For this reason we consider a reaction in a dilution of less than 1–300 without diagnostic value.

2. The bacillus of swine dysentery is not agglutinated by normal blood in such high dilutions.

3. The Widal reaction is of no value for the diagnosis of hog cholera, as the disease is at present defined.

4. The presence of a positive reaction does, however, indicate an infection with cholera bacilli.

5. There are occasional instances of both natural and artificial infection in which no increase of the agglutinins for hog cholera over those normally present can be demonstrated.

6. The maximum amount of agglutinin develops in a hog's blood within six or seven days after a single inoculation with hog cholera vaccine.

7. Hogs react to intraperitoneal injec-

tions of hog cholera vaccines, usually with the production of large quantities of agglutinins, the amount of the vaccine bearing no relation to the amount of agglutinin produced.

(Complete paper will be published in the *Journal of Infectious Diseases.*)

A Method for Inoculating Animals with Precise Amounts: M. J. Rosenau, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service.

The author gives an original method for inoculating animals with precise amounts. With the ordinary methods used in most laboratories there is an unavoidable loss resulting in an error of from one to eight per cent. If the solution is measured into a graduate and then drawn up into a syringe a certain quantity remains in the graduate, and the entire contents can not be expelled from the ordinary piston syringe. In a number of weighings this loss was determined to average about .04 c.c. in using 4 c.c. of fluid, that is, about one per cent. of the amount used.

The new method consists of a battery of syringe barrels, one for each animal. The amount of fluid is measured into the syringe barrel directly, thereby totally eliminating the loss in the graduate. The entire contents of the syringe is expelled by means of a rubber bulb and any fluid remaining behind is washed out with a neutral and sterile solution. The syringe itself is a modification of the Koch syringe.

In working with different weights of solids, the solution may be made in the barrel of the syringe, so that the method is applicable to any sort of work where it is important to inoculate animals with precise amounts.

The method is especially useful in standardizing diphtheria antitoxin, in determining the strength of toxins and in certain lines of physiological chemistry where the greatest precision is essential. The battery of syringes is held in a specially designed rack which has many useful points.

(Complete description in U. S. Public Health and Marine Hospital Service, Hygienic Laboratory Bulletin, No. 19.)

A Method for Using Capacity Pipettes: M. J. Rosenau, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service.

The pipette is held in a retort stand and has a rubber bulb attached to its upper or suction end. By means of a thumb-screw the fluid may be drawn up into the pipette to a point slightly above the mark. The outside of the pipette is then wiped with a piece of sterile gauze, and by applying a similar piece of gauze to the tip of the pipette the fluid may be drawn down so that the meniscus rests exactly on the line. The contents of the pipette may then be washed in and out by means of the rubber bulb into the syringe or vessel that is to contain it.

A Method for Using Delivery Pipettes. M. J. Rosenau, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service.

This is similar to the method described for using capacity pipettes and has a similar rubber bulb attached to the upper end of the pipette; but in addition, attached to a glass *T*, is a valve consisting of a piece of rubber tubing controlled by a Mohr's pinchcock. The fluid is drawn up above the mark, and is nursed down by means of a piece of sterile gauze, as related above in using capacity pipettes. By opening the pinchcock the contents of the pipette may be delivered into any vessel desired. The method is both quick and accurate.

Exhibition of Cultures on Starch Jelly and on Silicate Jelly: Erwin F. Smith, U. S. Department of Agriculture.

These media were recommended for dif-

ferential purposes. The preparation of the first is given in Proceedings Boston (1898) Meeting of the American Association for the Advancement of Science; that of the second will be given in the first volume of the writer's monograph on 'Bacterial Diseases of Plants' (Carnegie Institution). It is easy by this method to prepare a silicate jelly free from glycerine and at the same time having a moist, smooth (untorn) surface, well adapted to the growth of many bacteria and not at all to that of others. The nutrient salts used were those of Fermi's solution.

Introductory Remarks on Morphology of Bacteria: H. W. HILL, Boston Board of Health Laboratory.

The writer points out the chaotic state of the evidence relating to morphology, and the difficulty of determining what is the normal morphology of bacteria, supports the acceptance of artificial standards for temporary purposes and urges very much more detailed attention to every phase of morphology than has as yet generally been given to it, as a basis for a more exact abstract science of morphology. He recommends also more attention to the direct continuous microscopic examination of bacteria during the processes of fission, spore formation, spore germination, etc.

A Peculiar Spirillum Showing Rosette Formation: MABEL JONES, University of Chicago.

The organism in question was isolated in October, 1904, from the Chicago water supply and also from Chicago sewage.

The organism is a short, rather plump 'comma,' with pointed ends, frequently growing out into straight or spiral filaments or forming 's'-shaped figures and semicircles.

There is a singular tendency towards definite rosette formation. This grouping is shown in cover-slip films and is apparently effected by a uniform grouping of the descendants of a single organism, and is in no sense an agglutinative phenomenon. The flagella, pointing towards the center of the rosette, stain by ordinary stains and add to the singularity of the picture presented by these chrysanthemum-like clusters.

Glucose-agar under anaerobic conditions seems to favor the formation of rosettes.

(Will probably be published in the *Centralbl. f. Bakteriol.*, etc.)

Notes on the Chemical Constitution of Bacillus Tuberculosis: M. DORSET and J. A. EMERY, U. S. Bureau of Animal Industry.

The authors report having found in the bodies of tubercle bacilli two classes of substances soluble in water. One portion of the ether extract is not saponifiable by the usual methods and possesses many of the characteristics belonging to the higher alcohols of the aliphatic series. This alcohol is completely acid-fast and it seems probable that the characteristic staining properties of tubercle bacilli are due to its presence in them. The second portion of the ether extract is easily saponifiable and consists of several different substances the nature of which has not yet been determined.

(To be published in Annual Report, Bureau of Animal Industry, 1904.)

The Metabolism of Chromogenic Bacteria: M. X. SULLIVAN, Brown University.

I. The biochemical study of bacteria is carried on best in simple, synthetic culture media.

II. Some bacteria show little power to grow upon synthetic media; it is probable that the power to grow upon such media can be developed; thus we may accommodate the medium to the organism or adapt the organism to the medium.

III. Many bacteria may be grown readily upon synthetic culture media.

IV. From those readily growing on such media I have chosen for study *B. pyocyaneus, B. prodigiosus, B. ruber balticus, B. rosaceus, B. metalloides, B. violaceus, B. janthinus.*

V. These bacteria may be grown with or without pigment formation.

VI. Whether producing pigment or not, these chromogenic bacteria give the same metabolic products, as far as these have been analyzed, *e. g.*, acids, ammonia, alcohol, benzol derivatives and albuminous bodies.

VII. The metabolic products are as follows: *B. prodigiosus,* aldehydes, formic, acetic and citric acids; albumin. *B. rosaceus, B. metalloides,* formic and acetic acids; albumin. *B. ruber balticus,* formic acid; albumin. *B. violaceus,* aldehydes, formic acid; albumin. *B. janthinus,* formic acid; albumin. *B. pyocyaneus,* aldehydes, formic acid, mercaptan, H_2S; albumin.

The Intracellular Toxins: V. C. Vaughan, University of Michigan.

Bacterial cellular substance is obtained in large amount by growth on the large tanks which have been used for some years in the author's laboratory. After fourteen days of growth, the cell substance is removed, washed with water and absolute alcohol, then thoroughly extracted with ether, dried, pulverized, weighed and heated in a reflux condenser with sodium alcoholate. This splits the cell substance into a toxic and a non-toxic portion. The toxic part is soluble in absolute alcohol, while the non-toxic is insoluble in this reagent. The alcoholic solution is neutralized with hydrochloric acid and the sodium chloride, which forms, is removed by filtration. The filtrate is precipitated with an alcoholic solution of platinum chloride which precipitates the toxin. The platinum precipitate is suspended in absolute alcohol and decomposed with hydrogen sulphide, after which the alcoholic solution of the toxin is evaporated in vacuo. Animals have been immunized with this toxin both to the living germ and to the toxin itself. Animals treated with non-fatal and gradually increased doses of the toxin acquire immunity and furnish a blood serum which is both antitoxic and bacteriolytic. The toxin gives all the proteid color reactions. It is apparently an acid and combines with organic bases.

The non-toxic portion of the germ substance, or that which is insoluble in alcohol, is soluble in water, and with aqueous solutions of this substance bacteriolytic immunity is easily induced. Toxins have been obtained from colon, typhoid, and anthrax bacilli and animals have been immunized to the first two.

(To be published in the *Journal of the American Medical Association.*)

Relation of the Index of Alkalinity to the Production of Diphtheria Toxin: A. P. Hitchens, Glenolden, Pa.

A study of the reaction of bouillon before and after sterilization shows that in media containing carbohydrate the rise in acidity after sterilization varies according to the temperature of the sterilizer. This is most important in the production of diphtheria toxin. Bouillon prepared according to the method of Smith, and sterilized in the autoclave, showed after sterilization varying indices of alkalinity. The reaction after sterilization of sugar-free bouillon is very uniform. And as the reaction of bouillon for the production of diphtheria toxin must be very exact, it is advantageous to add the dextrose after sterilization. The meat juice is neutralized to litmus, planted with the colon bacillus and incubated over night to destroy the muscle sugar. The bouillon is made from

this in the ordinary way, two per cent. of Witte's peptone being added. It is dispensed into Fernbach flasks, one liter in each, and sterilized in the autoclave. Little attention need be paid to the temperature, it may vary anywhere from 115° to 120°, 0.2 per cent. of dextrose is added after sterilization. The cultures are incubated six days at 35°–36° C. The reaction of the bouillon before sterilization is made +.45, so that after sterilization it may be +.75. Toxin made by this method has been very uniform, rarely being below .005 c.c. for a 250-gram guinea-pig.

(To be published in the *Journal of Medical Research.*)

On the Antagonism of Bacteria and their Products towards Other Bacteria: L. F. RETTGER, Sheffield Scientific School, Yale University.

Considerable attention has been given in recent years to the influence that one microorganism is capable of exerting on the life and growth of another. We learn, on the one hand, that certain bacteria profit by association. Again, there are numerous instances in which the presence of one organism, or its products, is inimical to the development of another. For example, the *pyocyaneus* bacillus has been found to act in a very antagonistic manner toward the anthrax bacillus. And not only is this true of the living bacilli themselves, but also of certain of their products. Emmerich and Loew claim to have succeeded in immunizing rabbits against anthrax by the use of their so-called 'pyocyanase,' which they prepared from old bouillon cultures of *B. pyocyaneus.*

In a study of the chemical and physiological properties of *B. prodigiosus* and its products, I observed, among other things, that sterile cultures or preparations of the *prodigiosus* bacillus exerted a strong protective action against experimental anthrax when injected in small quantities under the skin or into the peritoneal cavity of guinea-pigs. Of nine experiments that were carried out in full, seven yielded very positive results. In the eighth the animal died as a result of over-dosing with the *prodigiosus* material; and in the ninth, both the *prodigiosus* and control animal lived, owing to the small number of anthrax bacilli injected (47). In six of the seven experiments that gave positive results, the life of the guinea-pig was prolonged 14, 24, 25, 26 and 72 hours, respectively; while in the seventh the animal entirely recovered.

The *prodigiosus* material used for injection was prepared from potato cultures of the *prodigiosus* bacillus. The cultures were scraped and allowed to stand under chloroform for twenty-four hours. After drying in an exhaust desiccator, the mass was ground into a fine powder. Definite quantities of this '*prodigiosus* powder' (0.05 to 0.1 gram) were mixed with ten cubic centimeters of sterile physiological salt solution, and after filtration through loose absorbent cotton definite amounts of the suspension were injected, usually under the skin of the abdomen and in rather close proximity to the site of the anthrax injection.

For inoculation with anthrax, young agar cultures were employed. The bacilli were suspended in physiological salt solution, and their number was approximately determined by the use of agar plates. The inoculation with anthrax was made under the skin of the abdomen. In all the experiments control animals were employed.

Although sterile *prodigiosus* powder exerts such a pronounced protective action against anthrax, there remains at present one serious objection to its employment in practical immunization work. It exerts such a degree of toxic action, when injected, that only very small quantities can be used without serious consequence to the animals. Attempts thus far made to destroy the toxic

properties of the *prodigiosus* products without lessening their protective action have not given the desired results.

Associative Action of Bacteria on the Souring of Milk: C. E. Marshall, Michigan Agricultural College.

The author, working with cultures of associated bacteria, consisting of *B. acidi lactici,* and a bacillus obtained from milk and not yet described, possessing marked proteolytic action in its growth upon milk, and producing alkaline reaction, decidedly marked in old cultures, has been able to demonstrate that loppering is hastened by the presence of this proteolytic germ over that of the lactic acid germ, by as many as ninety-six hours at times, temperature 20° C.; that the acidity rises high above that of the lactic germ; that these changes may be noted by the naked eye appearances of the cultures; and, further, that the lactic acid germ develops much more rapidly when associated with these proteolytic germs than when existing in pure cultures. He has also found that the products produced by the proteolytic germ are stable and that they may exert the same influence as the presence of the living germ. Analyses of cultures at various ages indicate that the products influencing the growth of the lactic acid germ are either amido or ammonia compounds. Synthetic cultural media have been attempted, but without satisfactory results thus far.

It may also be said that peculiar curdling effects have been obtained with fresh milk from the cow and of various ages thereafter. This may account for certain peculiar cultural results secured in cultivating germs in various samples of milk.

The description of the proteolytic germ and the detailed work will be published in *Centralbl. f. Bakteriol,* etc. (Zweite Abteilung), at no distant date.

Bacterium truttæ: A Pathogen to Trout: M. C. Marsh, U. S. Bureau of Fisheries.

An organism which causes serious epidemics among domesticated brook trout and is not pathogenic to warm-blooded animals. The characters of chief interest are its pleomorphism, color production, apparent acquirement of motility on media, and low death point.

(Complete paper in Bulletin of U. S. Fish Commission, 1902, p. 411.)

A Germ-proof Filter: F. P. Gorham, Brown University.

The filter consists of a porcelain tube upon which a layer of aluminum hydroxide, bound together by mineral wool, is deposited. The effluent is of excellent quality chemically, all algal odor is removed, is germ free after running continuously for over a year, and the rapidity of flow is some seven times that of the uncoated tube at the start, and double the speed of flow of an uncoated tube after a continuous run of fourteen days.

The filter is the invention of Mr. James G. Woolworth, Providence, R. I.

The Bacteria Encountered in Suppurations: D. H. Bergey, University of Pennsylvania.

In the examination of pus by the students in the laboratory it has been my experience that frequently bacteria are encountered which are not ordinarily classed among the pyogenic organisms. The frequency with which certain of these organisms were encountered and the fact that some of these organisms had previously been encountered in suppurating wounds; that organisms of a similar character had been encountered in catarrhal mammitis in cows; moreover, the fact that similar organisms have been encountered in abscesses occurring spontaneously in mice, led to the opinion that they might possibly have a

more intimate connection with suppuration under certain conditions than had been supposed. For this reason specimens of pus were obtained in the hospital from thirty cases in the surgical wards. Aside from the ordinary pyogenic organisms—as the staphylococci, streptococci and *Bacillus pyocyaneus*—bacillus coli was encountered several times; an organism belonging to the group of pseudo-diphtheria bacilli and also an organism belonging to the proteus group were encountered several times, so that it appeared probable that they were not accidental contaminations of the pus. The extent to which these organisms are capable of producing suppurations when acting alone has not been fully worked out. Neither has their effect upon the processes of the pyogenic organisms been studied with sufficient detail to make positive statements. The frequency, however, with which these organisms were encountered in the conditions studied seemed to warrant a preliminary report upon the studies so far made.

The Bacteriology of Some Railroad Water Supplies: L. H. PAMMEL, Iowa College of Agriculture.

The author gave an account of an examination of three water supplies of railroads. Generally speaking, the newer wells along the line of the C. & N. W. R. R. are deep wells, 125–150 feet deep. In some cases the Iowa railroads depend on city water supplies. It is interesting to note that in the few cases where the city water supplies have been used, *B. coli communis* has been found. Several new species have been found, among them a red *Planosarcina*. The average number of bacteria varies from 40–150, though in some cases somewhat higher. Best results have been obtained with litmus lactose agar; the gelatine has been unsatisfactory.

Changes in the Bacterial Content of Water in Passing Through a Distributing Reservoir: B. G. PHILBRICK, Metropolitan Water and Sewage Board, Boston, Mass.

The data reported represent routine weekly analysis, covering a period of ten years, of the influent and effluent streams of Chestnut Hill Reservoir. The number of bacteria in the influent is small, only 220 on the average, and is not markedly affected by rainfall, since the water experiences considerable storage and sedimentation before it reaches that point. The general average of bacteria in the effluent is 179, 82 per cent. of the influent figure, but the ratio for different years varies from 50 per cent. to 123 per cent. Considering the monthly average for ten years, an increase during passage through the reservoir is noted at the time of the spring and fall overturns bringing the ratio of effluent to influent up to 123 per cent. for April and 134 per cent. for September.

During the winter the ratio decreases from 96 per cent. in December to 71 per cent. in March and after the spring overturn it rises from 69 per cent. to 95 per cent. in August. It appears that in a reservoir receiving water fairly low in bacteria the growth at the bottom of the reservoir itself and the mixture of its various layers, are the main factors in determining the effluent count.

The New Bacteriological Laboratory of the Boston Board of Health. B. R. RICKARDS.

A detailed description of the new laboratory including several special features such as (1) chute leading to an incubator to receive cultures sent after the laboratory is closed, (2) open trough system of plumbing, (3) combination draining board and tray for the transportation of glassware from one part of the laboratory to another,

(4) Portland cement benchtops under incubators and on other benches where gas flames are in constant use.

The Construction of a Thermostat-room: N. MacL. Harris, University of Chicago.

Every well-appointed laboratory engaged in teaching large classes should have an incubator room. The costly copper thermostat is entirely inadequate. The thermostat in this case was built for the pathological laboratory of the Johns Hopkins University and was modeled somewhat after one seen in Kjoebenhavn, Denmark, and one in the Institute for Infectious Diseases in Berlin.

The cost of this room was one hundred and twenty dollars exclusive of the thermoregulator and Koch safety burner, a sum often exceeded by the larger sizes of the ordinary copper-built apparatus on the market.

A complete description of this room will soon appear in the *Journal of Experimental Medicine* or in the *Centralblatt für Bakteriologie.*

The Utilization of Leaky Incubators: C. F. Dawson, University of Florida.

The leaky incubator is not an uncommon piece of apparatus in the older laboratories. Owing to the difficulty with which they are kept in repair when once they have begun to go to pieces, it is doubtful economy to attempt, in most cases, to keep them in commission.

As in the case of old and tried friends, we dislike to part with them. Although it is not the possession of such an incubator, at present, that has prompted this short note, a long laboratory experience has shown me that many fine and expensive old ovens have been consigned to the worn-out apparatus pile, because of their leaky propensities.

The writer is at present using one of Bausch and Lomb's finest incubators, without the usual water-jacket, and has never seen a more perfectly regulated apparatus. In this case the mercury regulator is, of course, passed through one of the tubulatures into the culture chamber.

We thus directly regulate the amount of heat in the place where it is wanted, and not through the medium of heated water. Such an apparatus is easily and quickly regulated. There are no long periods of over-heating or under-heating, as is the case when we have a large volume of water to heat up or to cool down.

Some might object to the rapid cooling when the door is opened; but this is quickly counteracted by an almost immediate return to the temperature for which the regulator is set, when the door is closed again.

Were this system adopted the expensively constructed incubator would be a thing of the past, as cheaper materials, such as wood and tin, could be employed in their manufacture.

I., *Demonstration of an Efficient Thermo-Regulator:* A. Robin, Wilmington Water Department Laboratory.

The thermostat consists of an ordinary automatic gas burner, such as is sold in hardware stores, connected with a regulator made on the same principle as the minimum and maximum thermometer with three electrodes, one reaching 38° C., the other 37° C., and a third connected at the bend of the U tube. The spring wires opening and closing the valve in the gas burner are slightly bent so as to permit a small amount of gas to pass, thus doing away with the spark coil generally used to light the burner. Two open-cell constant-current batteries supply the necessary current. When the temperature in the incubator reaches 38° C. the mercury rises, making a contact with the electrode on

the dark side, and the flame is automatically turned down. When the temperature falls to 37° C., the mercury column on the left side makes the contact, turning on the flame. Thus, the temperature is regulated within one degree. Instead of the mercury regulator, one made of thin brass and hard rubber strips securely fastened together and arranged between two contact points, may be used. The metallic thermo-regulator may be bought in the open market.

II., *A Simple Method of Making Anaerobic Plates.*

The medium consists of lactose agar, 1.2 per cent., which is plated in the usual way and placed on a nivellator. When thoroughly solidified, 7 c.c. of an agar jelly made of 1.2 per cent. agar in distilled water, are poured on each plate making a closely adhering transparent film. This practically accomplishes what the mica plate does, with the advantage, however, that the agar film adheres more closely, covers the medium more satisfactorily and is readily applied.

Laboratory Expedients. S. DEM. GAGE, Lawrence Experiment Station.

In the modern public health laboratory, a large amount of routine work of considerable detail is often required, and while an increase in the necessary funds is often not forthcoming, constant pressure is usually exerted upon the head of the laboratory to increase the scope of the work and the output of the working force. Under these conditions it is often a problem for the working bacteriologist to satisfy all requirements and at the same time to be able to carry on experimental work. The solution of this problem usually lies in systematizing the work and in the use of labor-saving devices whereby the time consumed in routine work may be shortened. It is the purpose of the author in the present paper to describe some of the laboratory expedients at the Lawrence Experiment Station as regards both the system in vogue and the labor-saving devices in use there, under the following headings: (1) Apparatus should stand rough handling, (2) color system and use of tubes of different dimensions for identifying media, (3) dilution bottle filler, (4) apparatus for holding inoculating needles during sterilization, (5) improvised apparatus, (6) loose sheet system of keeping records, (7) methods of keeping track of samples and experiments, (8) numerical systems.

A Method for the Direct Microscopical Enumeration of Bacteria: C.-E. A. WINSLOW, Massachusetts Institute of Technology.

One twentieth of a cubic centimeter of the liquid to be examined is discharged from a sterile graduated pipette on a carefully cleaned cover glass of known diameter. This is dried in the air, fixed and stained in the usual way with carbol-fuchsin. The bacteria in ten square fields, 0.1 mm. on a side, are counted by the aid of a Sedgwick-Rafter micrometer and the total number determined by multiplication. The method is rapid, easy and accurate, but applicable only to fluids like sewage which contain 25,000 or more bacteria per cubic centimeter.

The results obtained when pure cultures are examined check very closely with those of the plate method even when the number of bacteria present is decreasing very materially. Thus it appears that dead bodies of bacteria are quickly removed in the presence of other living germs and introduce no serious error. On the other hand, sewage and sewage effluents show numbers 10 to 100 times as high as the plate count, due mainly to the inclusion of forms which do not grow on ordinary media.

Full paper to be printed in the *Journal of Infectious Diseases* (with G. E. Willcomb).

A Simple Method for Determining the Ability of Bacteria to Ferment Different Sugars: L. A. Rogers, U. S. Bureau of Animal Industry.

In volume VII., page 241, of the *Cent. f. Bakteriologie,* 2d Abt., Linder describes a simple method for the determination of the ability of yeasts to ferment different sugars. This method consists essentially in filling the cavity of a concave glass with sterile water, inoculating with yeast, adding a very small amount of the sugar and sealing on a cover glass. The fermentation of the sugar is indicated by the appearance of bubbles under the cover-glass.

With a few minor variations this method may be used with bacteria. For this purpose litmus is added to sugar-free bouillon until it has a deep blue color. The sugars to be tested are made to a syrup and sterilized in small phials. The slides and cover-glasses may be sterilized in Petri dishes. A single tube of the litmus bouillon is inoculated with the organism to be tested and incubated for a few hours. A ring of vaseline is run around the cavity of the slide while it is warm and the cavity completely filled with the culture. A loopful of the sugar solution is added to each and a cover-glass placed carefully over the cavity and pressed onto the vaseline without admitting any air bubbles. The surplus media may be taken up with a filter paper. After a period of incubation the fermentation of the different sugars will be indicated either by the appearance of gas bubbles or by the reddening of the litmus, or by both.

The advantages of this method over the ordinary fermentation tubes are the rapidity with which the fermentation of a large number of sugars may be determined and the very slight expense required for the sugars.

With the fermentation tube the expense of determining the fermentation of the rarer sugars is so great that the fermentative ability of an organism is ordinarily given for three or four sugars.

With the culture-slide method the amount of sugar used is so slight that a small amount may be kept always ready for use, thus obviating the necessity of keeping on hand a large number of different kinds of media. The danger of contamination may seem a serious obstacle, but with ordinary care it is very slight and may be reduced to a minimum by the use of a case for the protection of the slides. A convenient arrangement for this purpose is a box with glass sides made after the pattern of a balance case, with a sliding door so that the slides may be prepared with only the forearms inside the case.

A Simple Method of Cultivating Anaerobic Bacteria: B. R. Rickards, Boston Board of Health Laboratory.

With solid media, an ordinary inoculated slant or stab tube immersed mouth down in a receptacle containing alkaline pyrogallic acid is used. Plates are made by using an Erlenmeyer flask instead of a Petri dish, inverting and immersing as with tubes.

For liquid media, the Lawrence form of fermentation tube is used, the liquid being allowed to run into the closed arm before inverting and immersing the mouth of the tube in the pyrogallic acid.

(*Cent. f. Bakt.,* Orig. XXXVI., s. 557.)

New Apparatus: H. W. Hill, Boston Board of Health Laboratory.

Porous Top for Petri Dishes.—The porous top is an exact duplication, in porous flower-pot earthenware, of the ordinary glass top, and is used in every way

similarly to, and as a substitute for, the glass top, except that it is best not to wash it between uses.

Its function is to absorb the excess moisture which, when glass tops are used, results in 'spreaders.'

In use, the percentage of 'spread' plates found in routine plating work of milk on agar at 37° C. in a saturated atmosphere has been reduced from 38 per cent. with glass tops (plates inverted) to 3 per cent. with porous tops (plates not inverted).

(*Journal of Medical Research*, 1904, XIII., 93.)

Staining Bacterial Fields under Microscopic Observation.—This is a mechanical device for applying stains, decolorizers, mordants, etc., directly and readily to the lower smeared surface of a cover-slip, in such a manner as to stain, decolorize or mordant, successively, in any order, a selected microscopic field, while the same is under observation, with provision also for a water flush to remove the surplus solutions applied. Particularly useful for Gram's stain, comparison of different stains, etc.

Method for Obtaining Smears for Flagella Staining.—The organism to be obtained is grown in broth, on the principle that in broth flagella are better developed than on the solid media usually recommended. To remove the broth from the organisms, repeated centrifugalization, decantation and addition of distilled water or normal salt solution is used. Numerous experiments show that the centrifugalization does not denude the bacilli of flagella to any extent.

(*Journal of Medical Research*, 1904, XIII., 97.)

A Method of Obtaining a High Percentage of Serum from Blood: C. W. LINCOLN, Glenolden, Pa.

In this method the blood is drawn into a tall narrow bottle without shoulders. A drip flask is made of a narrow glass percolater of the same caliber as the blood bottle, resting on a wide mouth quart bottle, the two being bound together by a broad band of paper tied firmly to each. Into the bottom of the percolator is dropped an inverted cone of coiled nickeled wire, the upturned base of which shows a flat surface of coiled wire with interspaces of not over one fourth of an inch. A paper cap is put on the percolator and the whole sterilized together. When clotting has taken place and all the serum has been drawn or poured off, the clot is gently slid from the blood bottle into the drip flask, both being held nearly horizontally. The two vessels being of the same caliber, the clot is but slightly injured and rests on the wire cone on its tough buffy coat, so that the serum that drips is not at all reddened after the drip flask has stood in a refrigerator for 24 hours. By this method 46 per cent. of serum may be obtained and if the pouring is done in a comparatively dust-free room no contamination occurs.

Note on the Occurrence in the Natural Waters of Eastern Massachusetts of Bacteria Simulating Sewage Forms: E. G. SMITH, Massachusetts Institute of Technology.

The author has observed in studying the bacteria of natural waters that species occur with considerable frequency which exhibit to a marked degree the reactions of colon bacilli, and he points out that these organisms may sometimes lead to erroneous conclusions as to the sanitary quality of a water.

Examination of 100 samples of water taken from sources 'presumably polluted.' The samples are from springs and brooks, public water supplies, pools and other sources where rapid personal inspection of

the surroundings showed them not liable to pollution. These, for the most part, are through the eastern section of Massachusetts. Most of the samples contained forms liquefying gelatin so rapidly as to make the counting of numbers impossible after forty-eight hours at 20° C. The most striking fact is the prevalence in these open waters of the development of red colonies on lactose-litmus-agar, sixty of the samples showing distinct red colonies either on the surface or imbedded in the medium. All typical growths have been differentiated and found to give more or less fully the colon reactions. Open brooks such as would be used for any impounding reservoir give often the most questionable data when rigidly interpreted; for example, from a small brook flowing through woodland and abandoned pasture with no tillage land above gave as high as six red colonies, differentiating out as modified colon forms, to the cubic centimeter. In but two cases, however, has the writer been able to isolate the streptococci—once in an open brook near Whitman, Mass., and once near the mouth of Elmer's Brook in South Hadley, a famous trout stream. Neither of these are polluted waters as we understand them, but the above determinations should not be accepted as final until further study of the area may have removed all possibility of contamination from animals. So far as we have gone in this inquiry the statements of Houston appear to be justified. It is of some importance, therefore, that careful inquiry as to the occurrence of the streptococci forms in nature be continued. Any considerable pollution of a natural water by fecal material will show these forms, which are readily distinguishable on the litmus-lactose-agar plate; and if continued examinations may show them not to be present in normal country waters their significance from the sanitary point of view is evident.

The Steam Still: F. C. Harrison and B. Barlow, Ontario Agricultural College.

Some Large but Inexpensive Incubators for Teaching and Working Laboratories: S. C. Prescott, Massachusetts Institute of Technology.

Some Experiences with Test-tubes: H. A. Harding, Experiment Station, Geneva, N. Y.

Frederic P. Gorham,
Secretary.

Brown University,
Providence, R. I.

THE SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY.

The eighth annual meeting of this society was held, in conjunction with the meetings of the American Association for the Advancement of Science and the affiliated societies, at the University of Pennsylvania, Philadelphia, December 28–30, 1904, under the presidency of Dr. George T. Moore. The meeting was large in point of numbers, and in all ways successful. The following officers were elected for the ensuing year:

President—Professor E. C. Jeffrey, of Harvard University.

Vice-President—Dr. C. O. Townsend, of the United States Department of Agriculture.

Secretary-Treasurer—Professor W. F. Ganong, of Smith College.

The following new members were elected: Dr. G. P. Burns, of the University of Michigan; Dr. A. L. Dean, of Yale University; and Messrs. C. F. Kellerman, W. M. Scott and D. B. Swingle, of the United States Department of Agriculture. As its delegate to the International Botanical Congress in June the society elected Professor Farlow, and made provision for an alternate if he can not be present. The society accepted the principles, recommended by its committee of conference (published in this journal, XXI., 197), upon which it will merge, along with the Botanical Society of America and the American Myco-

logical Society, into a national Botanical Society. A committee, consisting of the present and retiring presidents and the secretary, was appointed to cooperate with committees of the other societies to take further steps towards bringing the union into effect. The society expressed by special vote its great appreciation of the hospitality of the university during the meeting, and its sincere thanks therefor.

The address of the president dealt with 'Applied Botany and its Dependence upon Scientific Research.' It has been printed in full in this journal. The papers, of which abstracts follow, were with but two exceptions presented in full and discussed, and include all that were admitted to the program. The abstracts are in every case by the authors.

Causes Inducing the Habit of Growth of Asparagus plumosus: Professor F. C. NEWCOMBE, University of Michigan.

The common asparagus fern so-called is grown as a dwarf or as a climbing plant, according to the space afforded the roots. It bears no functional leaves, but the work of carbon assimilation is performed by the branches, the ultimate ones of which occur in little tufts of needles. The remarkable thing about the habit of growth of the plant is its change from a radial structure to a dorsiventral, and a rather sudden change in its response to environment.

The young main stems of the plant are at first erect, positively heliotropic and negatively geotropic. At the time the secondary branches begin to grow out, however, in the dwarf plants the upper part of the main stem, or in the climbing plants the oldest lateral branch, assumes the horizontal position, and all members which subsequently grow from this horizontal piece take the horizontal position. This change to the horizontal position is made in the course of three to four days. It may be considered as due to the plant becoming diaheliotropic, or diageotropic, or the position may be the resultant of the antagonistic action of negative heliotropism and negative geotropism.

Experiments have shown that the horizontal position is the result of the plant changing its behavior towards gravitation. The stem changes from negative geotropism to diageotropism.

Further Observations on the Nature of Color in Plants: Dr. HENRY KRÆMER, Philadelphia College of Pharmacy.

1. According to the author's studies, plant color substances may be divided into two classes: (*a*) Organized color principles, which are characterized by being an organic part of the plastid body, these being insoluble in water or dilute alcohol, but soluble in xylol and similar solvents; and (*b*) unorganized color principles, which are not a fundamental or organic part of the plastid, these occurring in the vacuoles of the cells of the higher plants as well as fungi, and in the vacuolules of the plastids of the brown and red seaweeds, being further distinguished by being soluble in water and dilute alcohol and insoluble in xylol and similar solvents.

2. In the photosynthesis of the chloroplast the unorganized color substances may be produced in comparatively large amounts, as in (*a*) early spring foliage; (*b*) autumnal foliage; (*c*) the foliage of alpine plants; (*d*) the brown and red marine algæ; (*e*) the foliage of certain species or varieties of rose, beech, nasturtium, etc.

3. The original color of the unorganized color principle is neither blue as stated by Wiesner, nor red as given by Berzelius; but these colors, namely, blue and red, and their various shades and tints are dependent upon substances dissolved in the cell sap and which are associated with the color

substance; or are the result of decomposition or oxidation processes.

4. Unorganized color substances are distributed usually in largest amount at the terminus of the branch, as in foliage and flowers, or in roots, or in both tops and roots.

5. The wide distribution of so-called flower color substances in other parts of the plant than the flower, points to the conclusion that they are products of plastid activity, and are not to be considered as designated primarily for the attraction of insects when found in the flower.

6. The occurrence of chromoplasts in a reserve organ, as the tuberous root of the carrot, and the similar occurrence of chromoplasts and of reserve starch in the petals of the buttercup, suggests that the petals of the buttercup like the root of the carrot have the function of storing nutrient material. In both cases cells containing chromoplasts rich in nitrogenous substances are associated with cells containing reserve materials.

Some Undescribed Fossil Trees from the Eocene of Vermont: Professor E. C. Jeffrey, Harvard University.

As a result of the coal famine of the winter of 1902–3 the lignite beds of Brandon, Vt., were considerably exploited for fuel. A number of more or less well preserved specimens of wood were secured by Professor Perkins, of the University of Vermont, and communicated to the author for identification. A few pieces of the material were in a good state of preservation and proved to be a species of *Laurinoxylon*. Nearly all the remaining fragments belonged to a single species, which proved to be very badly decayed, so that it has not been possible as yet to determine it satisfactorily.

New Data Bearing on the Phylogeny of Pinus (illustrated): Professor E. C. Jeffrey, Harvard University.

As the result of the study of both internal and external features in a large number of species of *Pinus* ranging throughout North America, Europe and Asia, the following conclusions have been reached:

The genus *Pinus* is divisible into two series, *Scleropitys* and *Malacopitys*, which are not coincident with the sections *Pinaster* and *Strobus* of recent authors. In *Scleropitys* the cones (female) are generally strongly sclerified, and are often provided with a prickle or spine on the generally median umbo, especially when young; leaf-sheath persistent; leaf-trace double; two or more rows of resin canals in the first annual ring of wood, one of which is near the pith; marginal cells of the wood-rays dentate. In *Malacopitys* the cone (female) is of softer texture, and is generally quite without a prickle or spine on the generally terminal umbo; leaf-sheath deciduous; leaf-trace single; a single series of resin canals in the first annual ring of the wood, not near the pith; marginal cells of the medullary rays not dentate. Internal features of structure are of greater constancy and consequently of more value in tracing the larger lines of affinity in the pines.

The Bud Rot of the Coconut Palm in the West Indies (illustrated): Dr. Erwin F. Smith, Department of Agriculture.

General attention was first called to this disease by the reports of army officers during the American occupation of Cuba. The coconut palms were said to be dying in large numbers of some mysterious disease which should be investigated. Mr. Busck was sent by the U. S. Department of Agriculture to eastern Cuba, and subsequently reported on the entomological aspects of the disease. Later Mr. F. S. Earle reported

the occurrence of a bacterial bud rot of the coconut in Jamaica. The writer has since heard of its occurrence on the mainland in Central America, so that it may be assumed to occur all round the Caribbean. It was studied by the writer at Baracoa, Mata and Yumuri in eastern Cuba in April, 1904.

The disease has made decided advances since it was studied by Mr. Busck in 1901, especially at Mata, and if it continues to spread as it has done during the past ten years it will inevitably destroy the coconut industry of the island, and that, too, within the next ten or fifteen years. Already many of the planters are discouraged and not setting any more trees, since it now attacks trees of all ages, including quite young ones and those on the hills as well as those close to the sea. The disease is frequently known as 'the fever,' and often one sees where the bases of the trunks have been scorched with an idea of preventing the development of the disease. The disease is not lodged in the roots, however, nor in the stem. These in all cases appeared to be sound. The general symptoms are the yellowing and fall of the outer leaves, the shedding of the nuts, and some months later the death of the whole crown. The cause of this decline is not apparent until the tree is felled and the crown of leaves removed, including the wrappings of the strong terminal bud. The latter is then found to be the seat of the disease. This bud with its wrappings of young and tender leaves is found to be involved in the vilest sort of a bacterial soft rot—not unlike that of a decaying cabbage or potato, but smelling much worse, the stench resembling that of a slaughter-house. This rot, invisible until the numerous outer leaf-base wrappings are removed, often involves a diameter of several inches of soft tissues and a length of three or four feet, including flower buds and the whole of some of the soft fleshy white undeveloped leaves covering the bud and forming the so-called 'cabbage' of the palm. The rot stops very promptly with the harder tissues of the palm stem immediately under the bud and does not attack any of the developed leaves. It is a disease of the undeveloped tissues. When the tree is felled and opened up, carrion flies and vultures are promptly attracted by the horrible smell. Fly larvæ and various fungi were found in the parts most exposed to the air and longest diseased, but the advancing margin of the decay was occupied only by bacteria, of which there appeared to be several sorts. No yellow or green fluorescent bacteria were obtained from the rotting tissues. All were white organisms of the 'soft-rot' type, mostly plump short rods with rounded ends, but occasionally longer rods, all apparently gas producers. One of the commonest sorts formed round dense creamy white opalescent colonies on agar. Another formed thin gray-white iridescent colonies on agar. A terminal spore-bearing, tetanus-like organism was also often abundant in the decayed tissues, even close to the advancing margin of the rot, and this is probably an anaerobe as it was not obtained in any of the many cultures.

The picture of one diseased tree will answer for many. No fungi or insect injuries were found which could in the least account for the death of the trees. The disease is the result of a bacterial rot of the terminal bud and its wrappings, including the flower buds. The bacteria probably find their entrance through wounds of some sort, and their distribution is undoubtedly favored by carrion creatures. The larva found deepest down in the rotting tissues was that of the common scavenger fly, *Hermetia illucens* L. Occasionally the crown of a tree was found yellow from other causes, but if the youngest visible leaf (projecting five or six feet) was observed to be lopped over and wilting

or shriveled, the soft rot was sure to be found on cutting down the tree and removing the close-wrapped leaf bases. No attempt has yet been made to produce the disease by pure cultures.

Diseased trees should be felled and the terminal bud burned or properly disinfected with sulphate of copper. Only the most energetic action is likely to avail.

Some Diseases of Loblolly Pine Timber: Dr. Hermann von Schrenk, Department of Agriculture.

The wood of the loblolly pine when still in the living tree is destroyed by several fungi, notably *Trametes pini* and *Polyporus Schweinitzii*. After the timber is cut from the tree, it is very susceptible, particularly in southern climates, to fungus attacks, and is probably the least resistant of all American woods. A number of fungi grow on the outside of the timber, notably *Schizophyllum commune* and several Thelephoraceæ. These, however, do not attack the wood fibers, but grow on the sugar, starch or exuding resins. The worst enemy of the loblolly pine timber is *Lenzites sepiaria*, which causes the brown rot. The description of the various forms of fruiting bodies of this fungi were given, and an account of the experiments which were made during the last year to test the susceptibility of this timber, when cut during different months of the year. It was shown that by proper piling, the attacks of this fungus ought to be prevented for periods of at least twelve months.

Bacterial Infection by Way of the Stomata in Black Spot of the Plum: Dr. Erwin F. Smith, Department of Agriculture. (By title.)

Experiments were continued during the summer of 1904 with the bacterial black spot of the plum, and numerous infections by way of the stomata were obtained on leaves and green fruits by simply spraying upon the tree, agar-cultures of *P. pruni* dissolved in sterile water. This was done during a damp still evening, in which several light showers occurred. The spots were visible at the end of seven days and continued to increase for several weeks in the typical manner. Microtome sections in early stages of the spots show abundant bacterial occupation, beginning in the substomatic chamber. The organism was also recovered from the spots by means of agar poured plates in pure culture. A neighboring tree inoculated at the same time and in the same way, but with a different yellow organism, never showed any results of this copious inoculation. Neither did any spots develop on a second check tree. The disease appears to be one of meristematic tissues. No spots were obtained on full-grown green plums, inoculated two or three weeks prior to their ripening, although numerous attempts were made under what appeared to be very favorable conditions.

Burrill's Bacterial Disease of Broom Corn (illustrated): Dr. Erwin F. Smith and Miss Florence Hedges, Department of Agriculture.

In the summer of 1904, on one of the Agricultural Department farms in Washington, D. C., this disease was observed in such abundance and with such typical characteristics as to remove all doubt as to its origin. The elongating red-brown bl tbes were extremely numerous and fused readily, causing the death of many large leaves. The disease began on the lower leaves; but by the end of September it had reached the top of the plants (twelve feet) and had destroyed all leaves on the lower six feet, and badly spotted the remainder. A microscopic examination of various spots showed a bacterial focus to be present in each one. Poured plates made from these

spots on several different occasions yielded bacteria in enormous numbers, of one kind and in practically pure culture. Very characteristic also was the appearance on the under surface of the spots (the season was wet) of red crusts or scabs. These were so numerous as to be quite conspicuous. They consisted of bacteria which had oozed from the interior of the spots.

The infection takes place by way of the stomata and is favored by rainfall or dewfall. No insect injuries are necessary. The disease was obtained in the hot-house under strict control conditions by dissolving pure slant-agar cultures of the organism in sterile water and atomizing this upon the plants. Spots were visible at the end of ten days and were well developed in five or six weeks. Such spots contained the characteristic bacterial focus and yielded, on making poured plates, enormous quantities of the organism used, and in most cases nothing else. The disease was likewise produced in broom corn, starting with bacterial colonies obtained from leaf spots on field sorghum.

The red stain is a host reaction. The organism is not red, nor yellow, but pure white. It is not a yeast and is not associated with yeasts or with fungi. It does not produce gas but is strictly aerobic in peptone water with various carbon foods (dextrose, saccharose, lactose, maltose, mannit and glycerine). It forms small, round, white, slow-growing shiny surface colonies on agar plates. The growth on agar is often sticky and hard to remove; the organism blues litmus milk decidedly, and finally renders it gelatinous; it does not liquefy gelatin, does not reduce nitrates, produces little if any indol, grows very slowly on moist silicate jelly made with Fermi's solution, has little diastasic action on potato starch jelly. On potato cylinders growth is white and much the color of the potato; grays the potato moderately; clouds bouillon moderately. In bouillon there is a thin white rim, and in old cultures often zoogloeæ and sometimes a thin pellicle breaking down easily. Slow, long-continued growth in Uschinsky's solution, not much precipitate. Resisted drying 96 hours. Grows not at all or very feebly at 37.5° C.; grows more rapidly at 30° than at 20° C.; minimum temperature about 6° C. Thermal death point 47° C. Stands freezing well, *i. e.*, only about 20 per cent. killed. Occurs in the host plant and in culture media as a short rod with rounded ends, single or in pairs or rarely fours. It is motile but non-sporiferous, so far as yet observed.

Some varieties are much more subject to the disease than others, and there is good hope of overcoming the disease by selecting resistant plants for propagation.

Pecan Scab (*Fusicladium effusum* Wint.): Mr. W. A. ORTON, Department of Agriculture.

This paper will be published later as a bulletin of the Bureau of Plant Industry, U. S. Department of Agriculture. It describes a disease of considerable economic importance, caused by the above-named fungus, which attacks the leaves, twigs and nuts of cultivated pecans in our southern states. The fungus occurs on either side of the leaves and on the petioles, producing dead spots or distortions and defoliation. The new growth of the twigs is sometimes killed, but the greatest injury is to the nuts. The microscopic and cultural characters of the fungus were described. *Fusicladium caryigenum* E. & L. was found to be the same species. Favorable results from spraying experiments were reported.

Factors which Determine the Spread of Pear Blight: Mr. M. B. WAITE, Department of Agriculture.

(It has been impossible to obtain an abstract of this paper.)

Further Studies on the Starch Grain (third paper): Dr. Henry Kraemer, Philadelphia College of Pharmacy.

The author called attention to the alteration in the compound starch grains of the seeds of *Theobroma Cacao* on the application of heat, producing masses resembling the natural starch grains of corn, wheat, barley, rye and potato, in size and shape, and showing in some cases even a concentric or excentric lamellated structure.

In the micro-polariscopic examination of reserve starch grains of different origin, it was observed that in using a red and green selenite plate the yellow and blue areas did not occupy the same relative position in all of the grains, so that in the same field with the analyzer at a given position two kinds of grains were observed which were the complement of each other. Three explanations are suggested as accounting for this difference in the polarizing effects of different starch grains of the same origin:

1. It may be due to a difference in the shape and structure of the individual grains.

2. It may be due to a difference in composition of the different parts of the same grain.

3. Or it may be that there are two distinct kinds of grains. This view seems to offer the most plausible explanation for this phenomenon.

Regarding the Cause of Sap Pressure and Flow in the Maple: Dr. K. M. Wiegand, Cornell University.

Researches by various investigators have shown that the seat of pressure in the maple, during the sugar season, is not in the root, but in the aerial parts, principally in the trunk. It seems to be induced by temperature acting as a stimulus. When this rises past 2°–4° C. pressure results, but a freezing of the tissue is by no means necessary. The author has attempted, by the aid of mathematical calculation and the employment of other evidence at hand, to compare critically the various theories. It becomes evident that neither gas, water nor wood expansion, nor any combination of these, can account for the phenomenon. Neither can the freezing theory. We have left the theory that pressure is due to the living cells, which agrees well with the facts. Only the pith rays seem to be in the proper position in the wood to allow the production of pressure. Pressure in this case could be due only to the unequal permeability, in opposite directions, of the membrane at the two ends of the cell. This, quite likely, is caused by the penetration of the morning temperature. Water would tend to pass from the inner layers to the outer; and the solute, sugar, would be excreted as a necessary factor in the production of pressure.

Notes on Some Species of Agaricus (Psalliota): Professor G. F. Atkinson, Cornell University.

Photographs of eight or ten species were shown to illustrate characters and show some points in the development and formation of the veil and annulus. Photomicrographs of the spores of nearly all the species in the United States were also shown, and special attention was called to the value of these in a study of different species.

Nuclear Changes in Germinating Seeds: Professor Carrie M. Derick, McGill University.

In this paper a brief summary was given of the results of part of an investigation into the cytological conditions connected with anabiosis which had been begun under the direction of Professor Strasburger, at Bonn, and continued at McGill University.

Studies of resting seeds belonging to several genera and of germinating seeds indicate that the nucleus of the resting seed is homogeneous, with the exception of the nucleolus in which the chromatin is aggregated. As the nucleus passes from the resting to the active state, the nucleolus becomes vacuolated, and chromatin is gradually given off by it and distributed in the form of granules throughout the body of the nucleus. These granules increase in size and number and finally are aggregated to form the spireme, which segments, as usual, into chromosomes. The chromosomes do not, therefore, retain their individuality throughout the life-cycle of the organism, and are not constantly present as the differentiated bearers of the hereditary qualities of the plant.

The Recognition of Hybrid Characters in the Structure of the Vascular Cylinder as Expressed in the Genus Catalpa: Professor D. P. PENHALLOW, McGill University. (Presented in synopsis.)

In 1889 Professor C. S. Sargent published an account of an interesting and newly observed case of hybridization between two species of *Catalpa* which he designated as *Catalpa* × J. C. Teas in reference to the origin of the tree in the nursery of Mr. Teas of Carthage, Mo. The account referred to states that *Catalpa kaempferi* was planted in 1864 in a nursery containing *C. speciosa* and *C. bignonioides.* Eventually the first species produced a single pod of seeds which were wholly unlike anything hitherto known. When these seeds were planted they produced a tree almost intermediate in character between *C. kaempferi* and one of the American species. Mr. Teas was of the opinion that the cross was with *C. speciosa,* while Professor Sargent considered *C. bignonioides* as the other parent, basing his conclusions upon the fact that the flowers of *C. speciosa* were two to three weeks earlier than those of *C. kaempferi,* while the flowers of *C. bignonioides* are contemporaneous with those of the Japanese species. No other evidence has since been forthcoming, so far as I am aware, and the real American parentage of a most noteworthy addition to the ornamental trees of this country still remains in doubt. Within the last twelve years, opportunities have been presented to inquire into the evidence which might be secured from an anatomical point of view, and to determine to what extent, if any, the external alterations attendant upon hybridization were accompanied by corresponding internal structural changes. It was felt that the answer to this question might very largely contribute to a solution of the difficult problems relating to the origin of species, either by mutation or by hybridization, and permit of a more precise limitation of the characters which define a species.

An examination of typical material taken from the mature stem of the hybrid and from each of the possible parents, showed that the characters were to be most clearly recognized in transverse and tangential sections, especially in the former. A very careful analysis of all the structural features showed that out of a possible maximum of thirty-two, 34 per cent. were common to *Catalpa speciosa* only, and from the well-defined characteristics which it exhibited, it was possible to eliminate it from further consideration and to definitely determine that it could not be one of the parents. On the other hand, it appeared that there were 31 per cent. of characters common to the hybrid, *C. bignonioides* and *C. kaempferi,* while in the hybrid it was also possible to determine features which could not be accounted for except as the resultant of action between *C. kaempferi* and *C. bignonioides.* The evidence available shows that:

1. Hybrid characters are expressed in the structure of the vascular cylinder as well as in external alterations of form and color.

2. *Catalpa speciosa* is not in any way concerned in the production of the hybrid.

3. Teas' hybrid *Catalpa* is the product of a cross between *C. kaempferi* and *C. bignonioides*, thus confirming the conclusions already reached by Sargent on the basis of external morphology.

4. The dominant characters of the hybrid, as expressed in the internal structure, are those of the Japanese parent as similarly manifested externally.

5. The resultant characters are most strongly exhibited in transverse section, less so in the tangential and least of all in the radial.

6. Teas' *Catalpa* presents a degree of stability directly comparable with that exhibited by the willows, various species of *Crataegus* and many other plants which are commonly recognized as distinct species. Its origin is in direct harmony with Mendel's law and it should be given the status of a species for which the name *Catalpa teasi* is appropriate.

Polyembryony in Celtis (illustrated): Professor J. W. Toumey, Yale Forest School.

In the spring of 1901, 500 of the normal one-seeded fruits of *Celtis occidentalis* were planted. Seedlings grew from 98 per cent. of these fruits. The total number of seedlings obtained, however, was 580; that is, a little more than 10 per cent. of the fruits sown produced more than one seedling.

In 1902 and again in 1903 the drupaceous fruits of this species were again sown, with similar results. In 1903 the fruits of *Celtis reticulata* and *Celtis Mississippiensis* were sown. Both of these species, in some instances, developed more than one seedling from a single fruit, but not so frequently as in *Celtis occidentalis*.

On examination of a large number of ovaries in various stages of development, and mature fruits of *Celtis occidentalis* it was found that the development of more than 1 embryo in a single fruit arose as follows: (1) From double fruits. In 1,000 fruits examined 3 double ones were found. (2) From the development of two seeds within the same fruit. In 400 fruits examined 7 were found which contained 2 ovules each. In each of these cases one ovule was much larger than the other and both were attached to the wall of the ovary by a common funicle, indicating that they both arose from the same fundament. (3) From true polyembryony. In 200 of the young ovules that were fixed and sectioned 16 were found with from 2 to 4 embryos within a single embryo sac. In these cases the embryo arose directly from the tissue of the nucellus at the micropylar end of the ovule. When seeds, containing ovules resulting from true polyembryony were sown usually all of the embryos developed, as high as 4 developing from the same seed. The young seedlings that developed from such embryos were often imperfect and more or less grown together. Occasionally, however, they were approximately the same size, perfect and wholly separate. (4) From false polyembryony. From 200 of the young ovules fixed and sectioned 3 were found where 2 nucelli developed within the same integuments. Each nucellus developed an archesporium and ultimately an embryo sac. Assuming that both embryo sacs become fertilized and develop normally we would here have a case of 2 embryos within common seed coats; both developing from fertilized eggs. This is believed to be very unusual among angiosperms.

Nymphæa and the Monocotyls: Dr. Henry S. Conard, The Johns Hopkins University.

The speaker discussed some observations on the structure and development of

Nymphæa from a paper now in press. The embryo in its development and mature form is typically dicotyledonous in *Nymphæa*, though it lacks a suspensor in *Nuphar*. The primary root quickly perishes, and the stem becomes tuberous immediately above the epicotyl. The root tip of *Nuphar* resembles that of *Zea mais*, but in *Nymphæa* it is like that of Papilionaceæ and Cucurbitaceæ. The vascular bundle of the root of *Nymphæa* is radial and polyarch. The scattered bundles of the stem of *Nuphar* and some *Nymphæas* give place to a distinct vascular cylinder with leaf-gaps in the primitive *Nym. mexicana*. In no case are the bundles oriented as in monocotyls. From each leaf three traces come into the stem, one central and two lateral; they differ from many dicotyls only in possessing a transverse commissure connecting the three traces. No secondary growth of the bundles takes place in any part of the plant. In this and in the polyarch roots and in the short life of the primary root are the only similarities between *Nymphæa* and the monocotyls. These are best explained as adaptations to a long established aquatic habit.

An Exploration of a Peat-forming Lake (illustrated): Dr. G. P. BURNS, University of Michigan.

Perhaps no line of ecological research shows the deficiency of present methods better than the work on peat bogs. These are cited as examples of 'xerophytic' habitats and there are many theories offered explaining the presence of plants growing in them.

These theories differ widely. Nor can we expect them to do otherwise under present methods.

The first problem of the ecologist must be to gather and record facts, but these must be submitted, as far as possible, to experiment before attempting to determine their final value. As in all other lines of botanical research, experimental work is indispensable.

A study of the plants in peat-forming lakes near Ann Arbor, Mich., shows that they are by no means all xerophytes. With xerophytes are found many plants whose structure is either mesophytic or hydrophytic.

In fact, within a circle whose diameter is only a few feet may be found plants belonging to all three of these groups of plants.

Peat bogs then, as such, can not be called 'xerophytic' habitats.

W. F. GANONG,
Secretary.

SCIENTIFIC BOOKS.

Die Gletscher. By Dr. HANS HESS. Braunschweig, Friedrich Vieweg und Sohn. 1904. Large 8°, pp. xi + 426.

This is the only important work on glaciers that has appeared since the well-known book of Professor Heim was published in 1885, and it is of the same general excellent character. Dr. Hess has had a good preparation for writing the book by his training as a physicist, which is of much importance in the actual study of glaciers, and by many years of careful observations and measurements of the glaciers of the Oetzthal in conjunction with Professor Finsterwalder and Dr. Blümcke; and he makes many references to the very important observations which they have made, especially on the Vernagt and Hintereis glaciers, which have thrown so much light on the theory of glacier motion.

The plan of the book does not differ essentially from that of Professor Heim. The matter is presented inductively; first assembling the observations and facts and then giving the theories to account for them. The large amount of work which has been done in the last twenty years makes such a work very desirable and Dr. Hess has collected all the material and has presented it in a most attractive and interesting form.

He begins by giving the physical properties of ice with accounts of the experiments for determining the plasticity and other constants. The climate of glacial regions is considered, and then the forms of glaciers, which leads to a study of the position of the névé line; he gives the different methods for determining the height of this line, one of which, due to Dr. Hess, depends upon the forms of the contour lines above and below the névé line and can be used when one has a good contour map. Dr. Hess divides glaciers into two general classes; the Alpine type or the valley glaciers and the inland ice type, and says that these two are not separated by any definite line but that they gradually grade into each other through glaciers of intermediate type. A description of the general distribution of glaciers over the world completes the first part of the work.

The movement of glaciers is then discussed and many determinations of velocity are given. The very incomplete observations which we have bearing on the changes of velocity in passing from the surface to the bed, is supplemented by the observations of Dr. Hess, in which he shows by means of the theory given further on, that the average velocity through a particular section of the Hintereis glacier is less than the average velocity of the surface. The thickness of the ice was determined by borings which completely pierced the glacier, one of which was 153 meters deep. Dr. Hess was convinced, as a result of his general observations, that the blue bands of glaciers were merely modified strata, and by means of an artificial glacier, made up of layers of different colored wax, succeeded in making the original layers take the forms which the bands assume. In the chapter on 'Ice and Rock,' the phenomena of moraines, superficial and internal, are described, following the classification adopted at the Rhone conference in 1899. He considers that glaciers are strong erosive agents and fortifies this view by a measurement of the quantity of material being brought to the surface by one of the internal moraines. The origin of this moraine he follows to a snow-covered peak in the region of the reservoir, whose character is such that he thinks the material could not have fallen from its surface and must therefore have been derived from the glacier's bed. In the chapter on 'The Ice Age' he also shows how the valleys have changed their shapes into the well-known glacial troughs.

A very interesting account is given of the variations of glaciers. Beginning with the seasonal changes, he goes on to describe the larger variations which follow Bruckner's period and he collects together the observations that have been made on this subject. He considers that the main cause of the glacial variations are variations of climate but that this is greatly modified by topographic conditions. Glaciers like the Vernagt, which have a large basin-like reservoir and a narrow tongue, do not begin to advance until there has been a large collection of snow in the reservoir and then the advance takes place very rapidly; whereas another glacier, whose outlet from the reservoir is broad and open, will probably respond quickly to climatic changes. He describes very interesting changes that have taken place in the Vernagt glacier since 1895, when the accumulation in the reservoir began to show itself; the end continued to retreat until 1897, after which came an advance. This advance seems to have run its course as the glacier is now about stationary. The observations showed that the ice grew thicker in the reservoir and that what might be called a wave advanced along the glacier to its end, very greatly increasing the velocity of the ice and itself moving still more rapidly. The historical theories of the cause of glacial motion are described; Dr. Hess looks upon the plasticity of ice as the property which allows it to flow. It is only at this point that he takes up the geometrical theory of glacial motion, given simultaneously by Finsterwalder and by Reid, and describes the lines of flow and the relations existing between accumulation, flow and melting. This theory is so fundamental in its bearings on all glacial phenomena that it might have been given with advantage in an earlier part of the book. This is followed by an account of Professor Finsterwalder's mathematical theory of glacier variations. In this theory, Professor Finsterwalder

expresses the fact that the increase in any section is equal to the difference between the ice which enters and leaves it, less the amount melted. Assuming that the velocity is in proportion to the square root of the thickness, that the melting is proportional to the horizontal projection of the surface and that there are certain fundamental variations of thickness at the névé line, which may be considered as due to climatic changes, Professor Finsterwalder finds that a glacier will go through variations which correspond very well with those observed. This is a most excellent beginning of a more exact understanding of glacial variations, though the assumptions are by no means accurate. The last chapter contains an account of the 'Ice Age' with special descriptions of the Alps in that period and describes the changes which have taken place in the topography as a result of the occupation of the valleys by the glaciers. The Ice Age, of course, can not be treated fully except in one or more volumes by itself.

In conclusion, we may say that the book is well and clearly written and is thoroughly reliable in its facts; it will be of the greatest value to all students of glaciers.

HARRY FIELDING REID.
JOHNS HOPKINS UNIVERSITY,
March 11, 1905.

The Varnishes of the Italian Violin Makers of the Sixteenth, Seventeenth and Eighteenth Centuries and their Influence on Tone. By GEORGE FRY, F.L.S., F.C.S. London, Stevens and Sons, Ltd. 1904.

About a fifth of the book deals with the minute description of the old violin varnishes as used by the best Italian makers. This is important as it is the only means of determining the composition of them, for it is clearly out of the question to remove the varnish from Straduarius violins and analyze it.

Following this is a chapter upon the influence of varnish upon the tone of violins, in which is shown that it has a decided influence and that oil rather than spirit varnishes are to be preferred. Two chapters are devoted to the manufacture of oil varnishes and those from turpentine derivatives.

The most important part of the book is contained in the last two chapters, in which the author thinks it more reasonable that the varnishes used in Italy were made from the materials close at hand—turpentine, linseed oil and rosin, the latter oxidized by treatment with nitric acid—than from some remarkable mystical gum. He substantiates his theory by describing a series of sixteen experiments in the manufacture of varnishes, using a nitrated mixture of rosin and linseed oil. A number of interesting problems are discussed, as, for example, the production of dichroism in varnishes, and studies in the drying of varnishes, the fact that age in violins is a detriment rather than an advantage, as usually supposed. Incidentally it should be remarked that the processes of manufacturing the nitrated varnishes have been patented in this country and abroad. The work is a valuable one to both the violin and the varnish maker, particularly to the latter on account of the material relating to the nitro-oleo varnishes which, so far as the reviewer is informed, is new.

A. H. GILL.

SCIENTIFIC JOURNALS AND ARTICLES.

THE opening article in the *Journal of Nervous and Mental Diseases* for March is by Dr. H. A. Hoppe, who discusses under the title of 'Soul Paralysis' some very interesting problems of the higher reflex acts, dealing with the relation between sensory stimuli and motor activity. This article is followed by a careful report by Dr. F. Robertson Sims of the 'Anatomical Findings in two Cases of Korsakoff's Symptom-complex.' Dr. Charles W. Burr reports a case of myasthenia gravis with autopsy, adding one more to the list of cases in which the thymus gland was persistent or persistent and diseased in the adult and associated with lymphoid infiltration of the muscles. The case is particularly interesting clinically because of the presence of visual symptoms, most frequently met with in and formerly regarded as pathognomonic of hysteria. Dr. S. G. Webber adds two more cases to the literature of multiple sclerosis, and suggests that the apparent rarity of the disease may be partially due to failure to get correctly diag-

nosed, the cases in question having been diagnosed as tumor of brain and locomotor ataxia, respectively, and their true nature revealed only by the autopsy. The proceedings of the Philadelphia Neurological Society for November 22, 1904, are reported, and the 'Periscope' contains numerous abstracts.

SOCIETIES AND ACADEMIES.

THE AMERICAN MATHEMATICAL SOCIETY.

THE one hundred and twenty-second regular meeting of the American Mathematical Society was held at Columbia University, on Saturday, February 25, 1905. The attendance at the two sessions was about fifty, including forty-two members of the society. The vice-presidents, Professors Pierpont and E. W. Brown, presided at the morning and afternoon sessions respectively. The council announced the election of the following persons to membership in the society: Miss A. F. Becker, Yeatman High School, St. Louis, Mo.; Professor C. H. Beckett, Purdue University; Professor W. De W. Cairns, Oberlin College; Professor S. C. Davisson, Indiana University; Dr. J. S. French, Jacob Tome Institute; Mr. F. H. Hodge, Clark University; Mr. A. E. Joslyn, Armour Institute of Technology; Dr. J. W. Lowber, Austin, Texas; Mr. J. H. Maclagan-Wedderburn, University of Chicago; Mr. G. A. Plimpton, New York City; Mr. E. W. Ponzer, University of Illinois; Mr. H. W. Reddick, University of Illinois; Miss M. E. Sinclair, University of Nebraska; Dr. A. W. Smith, Colgate University. Ten applications for membership were received.

Professor E. B. Van Vleck was elected a member of the Editorial Committee of the *Transactions*, to succeed Professor T. S. Fiske, who retires with the completion of the present volume.

The following papers were read at this meeting:

L. D. AMES: 'The theorem that a closed simple surface is bilateral.'

C. L. BOUTON: 'Note on isothermal curves and one-parameter groups of conformal transformations in the plane.'

E. W. BROWN: 'Note on the variation of the arbitrary and given constants in dynamical equations.'

O. E. GLENN: 'Determination of the abstract groups of order p^2qr.'

F. R. SHARPE: 'The stability of the motion of a viscous liquid.'

JAMES PIERPONT: 'Note on infinite products.'

CHARLOTTE A. SCOTT: 'The elementary treatment of conics by means of the regulus.'

A. W. SMITH: 'The symbolic treatment of differential geometry.'

A. M. HILTEBEITEL: 'Note on a problem in mechanics.'

R. B. ALLEN: 'Hypercomplex number systems with respect to a domain of rationality.'

L. P. EISENHART: 'Note on the deformation of surfaces of translation.'

A meeting of the San Francisco Section of the society was also held on February 25, at Stanford University. The next meeting of the society falls on Saturday, April 29. The Chicago Section will meet at the University of Chicago, April 22. The summer meeting of the society will be held at Williams College, Williamstown, Mass., September 7–8.

F. N. COLE,
Secretary.

THE NEW YORK ACADEMY OF SCIENCES.
SECTION OF GEOLOGY AND MINERALOGY.

AT the meeting on March 6 the following paper was read by title:

On the Absence of Helium from Carnotite: Dr. E. P. ADAMS.

The following paper was presented in full:

Notes on the Minnewaska Region, Ulster Co., New York: F. WILTON JAMES.

The stripping of the grit from the crest of the second anticline of the Shawangunk* appears to be due to a slight cross fold by anticlinal fracture and erosion, as the rocks at the southwest end of the eroded area show an upward pitch. Through this depression the Peterskill probably flowed while its own valley and Coxing Clove were dammed by the front of the ice sheet, and cut then the Paltz Gap in the crest of the first anticline, 200 feet deep, through which the road to New Paltz now runs.

* Darton, Rep. 47, N. Y. State Mus.

The basin of Lake Minnewaska is vertical-walled except at the southwestern end. The cliffs are highest under Cliff House, where they stand 160 feet above the surface of the lake and 65 feet below it. The grit is probably about 230 feet thick here. The walls are pierced by four crevasses now filled with drift—the remains of two fissures crossing each other at the deepest point in the lake, 74 feet deep. There is no drift in the lake basin, not even under the south-facing cliffs, although the fissure running S. 25° W. is filled, and the transverse breach is blocked to 150 feet above the lake. The glaciation is here S. 10° W. The cause of the absence of drift is not clear; elsewhere the cliffs are heavily skirted.

Lake Awosting lies along a vertical fault plane drift filled at both ends. The fault has not been studied. The north wall of the Palmaghat is a vertical fault of 200 feet throw. Both these faults seem to be derived from the overthrown anticline of the Coxingkill escarpment. Mr. Darton is in error in declaring the absence of extended faults.

The next paper was by Dr. A. A. Julien on the 'Determination of Brucite as a Rock Constituent.'

After a brief review of the life of Dr. Archibald Bruce, of New York City, the discoverer of the mineral, the fact of its wide distribution was set forth, both in limestones and serpentinoids, either in its unchanged condition or in the form of its derivatives, especially magnesite and hydromagnesite, as maintained by Volger in 1855. The following are its most marked characteristics for recognition as a rock constituent.

1. In addition to the known basal cleavage, two other systems may be distinguished on plates or folia; that of the hexagonal prism, often becoming rhombohedral, intersecting at 60° or 120°; and that of the hexagonal pyramid, intersecting at 90°.

2. Nemalitic structure or fibration, commonly occurring in brucite within serpentinoids subjected to dynamic stresses. The major axis of elasticity always lies parallel to the direction of the fibers.

3. Refractive index 1.57, sufficient, when the associated minerals are pure, to distinguish it by the Becke method from serpentine on the one hand and from amphiboles, dolomite, etc., on the other.

4. Birefringence ($\gamma - a = 0.020$), presenting interference colors of the upper first order up to sky blue of lower second order, in plates or sections of the usual thinness.

5. Characteristic strain phenomena; particularly by disturbance of the interference figure, examined by convergent light in basal cleavage plates or folia; also by a variable, small extinction angle in sections parallel to the vertical axis.

6. Optically positive character of the uniaxial figure, in distinction from talc, serpentine, etc.

7. Occasional twinning, observed in crystals enclosed in limestone.

8. Certain chemical tests, in confirmation of the optical diagnosis.

A. W. GRABAU,
Secretary.

COLUMBIA UNIVERSITY.

THE TORREY BOTANICAL CLUB.

THE meeting was held at the New York Botanical Garden, February 22, 1905, Professor L. M. Underwood in the chair and twenty-one members present.

A contribution to the local flora by Mrs. Livingston and Miss Crane was communicated by W. A. Murrill and read by Professor Underwood. The authors had worked on the fungi, and had identified 195 species in 82 genera and 17 families, all from Scarsdale, N. Y. The balance of the program consisted of remarks on the genus *Lycopodium*, being some of the results of the joint labors of Professor F. E. Lloyd and Professor L. M. Underwood, which will soon be published in the *Bulletin*. Professor Lloyd spoke from a morphological standpoint and Professor Underwood from a more general one.

Professor Lloyd called attention to the differences which were found to be diagnostic, that were brought out by the wet method used for the investigations, differences not distinguishable in dried material. The lycopods fall naturally into two physiological groups as shown by their morphological characters, de-

pendent upon habit—a radially symmetrical type for those species which are erect or pendent, and a bilaterally symmetrical type which may be purely physiological due to a twisting of leaves or stems or to the development of dimorphism in the leaves. Many interesting features were brought out with the aid of the blackboard.

Professor Underwood spoke of the number of new species brought to light by recent exploration, and comparative study of material from the American tropics, scarcely any of which are common to the United States. The lycopods which in our latitude are inconspicuous and comparatively infrequent, in the tropics occasionally become weeds of large size and great beauty, growing especially in high altitudes, in fact most of the more interesting tropical Pteridophyta are found above the 5,000-foot level. Many specimens were exhibited.

Edward W. Berry,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 597th meeting was held February 18, 1905.

Mr. J. W. Spencer, of the Hydrographic Office, presented a number of physiographic charts showing drowned river valleys and continental slopes in various parts of the ocean, and from these argued 'On the Physiographic Improbability of Land at the North Pole.'

The continental shelf north of Eurasia is now known to attain a breadth of 300–350 nautical miles, with its border reaching to a general depth of 300 feet, though there is a lower platform (to 1,200–1,500 feet in Barentz Sea). Beyond this edge, Nansen discovered the great continental slope down to 12,000 feet. This discovery precluded the occurrence of land until islands should be found on the American shelf, the position of which has not been observed. From the occurrence of fjords reaching from 1,200 to 4,000 feet on the eastern side of the American archipelago; of others to over 2,400 feet on the northern side, at a point even 200 miles within the line of the archipelago, and from the occurrence of deep fjords on three sides of Beaumont Sea to the west, it may be concluded that the continental shelf will be found at 50–100 miles north of the present known line of islands. This would correspond with the general characteristics of continental shelves trenched by deep fjords and valleys off the coast of Norway, Greenland and elsewhere. Accordingly, from all physiographic analogies, there is no reason to expect land within 300 miles of the pole or a little more. When explorers shall have reached a point north of Grant Land, where the depth is even less than 2,000 feet, they will have established the fact that there is a sea extending to the Siberian side, and scientifically their work will have been completed in the polar region.

Dr. Harris, of the Coast Survey, urged briefly that these conclusions were irreconcilable with the conclusions he had presented some months ago based on the study of tides and currents in the Arctic Basin.

Interesting memorial addresses were read, one by Dr. W. H. Dall on Marcus Baker, a past president of the society, the other by Mr. H. G. Ogden on Adolphus Lindenkohl, late the chief map draftsman of the Coast and Geodetic Survey.

Mr. Edwin Smith then spoke on 'The New Transpacific Longitude Determinations.' The probable error of the longitude of Manila *viâ* the United States is .059 sec.; the new determination agrees with the mean of the older ones *viâ* Asia (which are not wholly corrected for personal equation) within the error stated. The results have already appeared in Science.

Mr. E. G. Fischer exhibited and described the 'Rapid Recording Sounding Apparatus' of the Coast Survey. In this a weight hung from a wire wound on a reel operated by hand is allowed to drop to the bottom; the wire runs over a measuring wheel with printing attachment operating on a paper strip; a time stamp of ordinary type is placed to record on the strip close by the wheels. When the operator feels that the weight touches bottom he reverses the reel and this operation causes all the printing devices to make their records; these are correct to 0.2 foot and may be made very rapidly.

Charles K. Wead,
Secretary.

THE CONFERENCE OF NEUROLOGY AND VERTEBRATE ZOOLOGY OF CORNELL UNIVERSITY.

AT the conference of the department of neurology and vertebrate zoology at Cornell University, February 7, Alfred C. Weed, '05, presented the results of his study of the Brazilian Siluridæ or cat-fishes in the museum. They were collected in 1870 by Charles Frederick Hartt, the first Cornell professor of geology and paleontology; he was a pupil of the elder Agassiz, whom he accompanied on the Thayer expedition in 1865; in 1870 he organized the Morgan expedition from Cornell University, and in 1878 died in Brazil of yellow fever. Among the numerous valuable specimens obtained by Hartt and his associates were ninety siluroids. Some years ago they were sent for identification to Professor C. H. Eigenmann, of the Indiana University, with the privilege of retaining some duplicates and describing the new species. There were found two new species, described by Kindle in 1894 as *Hassar wilderi* and *Hemiancistrus longipinnis*. Of the latter, through inadvertence, but one example was sent. In the Cornell museum, in addition to a mounted specimen that had been mounted so as to display the tufts of interopercular bristles and the tail, 'obliquely truncated, the lower lobe produced,' Mr. Weed has found two alcoholic examples; one will be sent to Dr. Eigenmann and the other to the Museum of Comparative Zoology at Cambridge.

BURT G. WILDER.

THE AMERICAN CHEMICAL SOCIETY.
NORTHEASTERN SECTION.

THE fifty-eighth regular meeting of the section was held on Friday evening, February 24, in the Lowell building, Massachusetts Institute of Technology, with President Norris in the chair. About seventy-five members were present.

Mr. Charles A. Kraus, of the Massachusetts Institute of Technology, gave an experimental lecture on 'The Chemistry of Liquid Ammonia Solutions,' in which he described the solubility of various bodies in liquid ammonia which possesses a high solvent power for many substances, especially those containing carbon, with many of which it gives brilliant colored solutions. Electrolytic dissociation in ammonia solutions was discussed, and it was shown that ammonia was a much weaker electrolytic agent than water, the ions traveling 2.8 times faster in it than in the latter solvent. The alkali metals sodium and potassium are very soluble in NH_3, and the solutions conduct electricity like a metallic conductor.

ARTHUR M. COMEY,
Secretary.

DISCUSSION AND CORRESPONDENCE.

LITERARY PRODUCTION ABOVE FORTY.

TO THE EDITOR OF SCIENCE: Your making available, by quotation in the last issue of SCIENCE, the precise form of Professor Osler's much discussed 'obsessions' concerning the comparative uselessness of men above 40 years of age suggested an inquiry into the period of production in the lives of American men of letters, literature being one of the fields of achievement from which, Dr. Osler believes, we could well spare the work done by men above 40.

Even in poetry, where there might be especial reasons for the view, the case is doubtful. Bryant, indeed, wrote his most noted poems before 40, but wrote others quite as good at 70. Poe and Lanier died at 40 and 39, so their evidence is inconclusive. But Longfellow wrote 'Evangeline' at 40, 'Hiawatha' at 48, and 'Miles Standish' at 51; Whittier wrote 'Snow Bound,' his best and most characteristic poem, at 59; Whitman had done but little before his first considerable volume at 41. Lowell, alone of the more noted American poets, produced practically all of his best verse before 40; practically all of his best prose was written afterwards.

In prose, everything goes to disprove an age limit of 40. Except Jefferson's draft of the 'Declaration of Independence' (written at 33), Irving's 'Sketch-Book' (at 36), Thoreau's 'Walden' (at 37), Cooper's best novels, and, for the reason given above, all of Poe's prose, almost every notable piece of American prose was written after its author had reached 40. Some came much later—Edwards's 'Freedom of the Will' at 51,

Franklin's 'Autobiography' after 51, and Irving's 'Alhambra' at 49. Hawthorne began his series of great romances with 'The Scarlet Letter' at 46. Mrs. Stowe wrote 'Uncle Tom' at 41. Mark Twain produced 'Innocents Abroad' before 40, but 'Tom Sawyer' and 'Huckleberry Finn' considerably later. Lincoln delivered the 'Gettysburg Address' at 54, Webster his 'Reply to Hayne' at 48. Prescott wrote the 'Conquest of Mexico' at 47; Bancroft's 'History' occupied him from 34 until 75. Motley wrote the 'Dutch Republic' at 42; Parkman did not begin his series of volumes on 'France and England in North America' until he was 42. The first and the second series of Emerson's 'Essays' appeared at 38 and 41, respectively. Dr. Holmes wrote the 'Autocrat' at 49, Dr. Hale, 'The Man Without a Country' at 46. John Fiske did his best work, as Mr. Stedman has done his, after 40. Mr. Howells had scarcely made a beginning of his characteristic work before 40; Mr. James had made a good beginning, but the most and the best of his works have come later.

Indeed, if one were to generalize at all from this data concerning works notable in themselves and most characteristic of their authors, the conclusion for American literature would not be that no work of the first rank had been done by men above 40, but that the period of life conspicuous for superior production was between 40 and 50, and that, as Bulwer-Lytton suggested, real maturity seldom comes before the age of 35.

Clyde Furst.

Columbia University.

Production and the Modern Use of Carbonic Acid.

To the Editor of Science: Referring to Science for January 27, there appears on page 151, a brief extract of a paper by John C. Minor, Jr., presented to the New York Section of the American Chemical Society on December 9. The title of this paper, as given, is the 'Production and Modern Use of Carbonic Acid.' In the abstract, however, there is no reference to carbonic acid; the paper appears to deal entirely with carbon dioxide, and I suppose this is another case of the common misuse of this term. I would suggest that you make some effort to correct this prevalent error, because if we should want to talk about the real carbonic acid, there would be no way of conveying the meaning intended, unless the chemical symbol be used, because as it is, CO_2 has monopolized for itself two names.

A. Bement.

Mont Pélée?

Although nothing is commoner than instances of mistaken etymology, it rarely happens that a single name admits of so many interpretations as does 'Mont Pelée sive Mont Pelé.'

Having gone through in my own mind all the possibilities of the name, from that of the Hawaiian goddess, with which I started, to that of Pelée = bald, a good name for a bare summit, I have come at last to believe that it is simply the Gallicized form (Pélée) of the Greek Peleus, the son of Æacus and father of Achilles—*Mount Peleus* has a likely sound and needs no explanation of its gender. The form Pélée for Peleus is found in Littré.

Harris Hawthorne Wilder.

Smith College.

Special Articles.

Natural Mounds or 'Hog-Wallows.'

The paper of Mr. A. C. Veatch reported in Science, No. 530, p. 310, is of much interest to those acquainted with the natural mounds or hog-wallows of California and Oregon. Such mounds are especially abundant along the east side of the San Joaquin valley in California, where they cover hundreds of square miles, and extend from the valley floor, where they are most abundant, up the slopes of the foot-hills to an elevation of more than five hundred feet. The underlying rocks vary from Pleistocene gravels, sands and clays to granites, schists and folded paleozoic slates. I have never found them, however, in the sandy river bottoms. In height they range from one foot to four feet, and in diameter from ten to more than fifty feet. They are equally abundant in eastern Oregon and in

some parts of the drift-covered portions of the region south of Puget Sound.

The theories usually advanced in explanation of these mounds on the Pacific coast are: (1) Surface erosion, (2) glacial origin, (3) æolian origin, (4) human origin, (5) burrowing animals, including ants, (6) fish-nests exposed by elevation.

Bearing upon the theory of ant origin mentioned by Mr. Veatch, something will be found in the *Bulletin of the Geological Society of America,* Vol. VII., pp. 295–300, and also in the *Journal of Geology,* VIII., 151–153. It ought to be noted, however, that the ant-hills of the tropics with which I am acquainted, remarkable and abundant as they are, do not much resemble the hog-wallows or prairie mounds. Perhaps, however, no great stress can be placed upon this difference. The ant-hills of Brazil vary greatly in size and form, according to the species building them and according to the soil. If it be assumed that the ants built the mounds in this country and disappeared long ago, it is to be expected that time would have greatly modified and toned down their original relief. It is, perhaps, worthy of note, and may be of interest in connection with the ant-hill theory, that in western Washington and in parts of California they are partly on glacial soils, that is, on drift or on sediments spread over the San Joaquin valley during the glacial epoch. The glacial theory of their origin suggested by the letter of Wallace in *Nature,* XV., 274, is without support—the glaciers in California did not reach the region of the hog-wallows in the San Joaquin valley.

In addition to what Mr. Veatch says of the distribution of the mounds in the Mississippi valley it may be stated that they follow up the valley of the Arkansas and of the Neosho rivers across Indian Territory into southeastern Kansas. In Arkansas and Indian Territory they are common in forests as well as in prairies.

It is supposed that sections through these mounds would explain them. In California hundreds of mounds have been cut through by railways and by common roads, and many such sections have been examined. The cuttings, being made without any special care, exhibit only a compact clayey 'hard-pan' that shows no signs of burrows or anything that has been recognized thus far as different from the soil of the adjacent areas. In the San Joaquin valley the soil of the hog-wallows is not regarded as good. In some places it is so hard that it is very difficult to plow it. In the region between the San Joaquin River and the city of Fresno the soil of these hog-wallows is mostly of quartz, feldspar, mica and hornblende, with a little clay and some iron. These materials are derived from the granites and other crystalline rocks of the mountains to the east. One section examined in a pit eight feet deep and one thousand feet north of Herndon station is spoken of in my notes as a 'hard-pan of quartz sand, clay and feldspar resembling a horizontally bedded sandstone with some clay in it.'

Similar mounds occur in many places and covering large areas over the flat prairie lands along the eastern slopes of the Andes in the Argentine Republic. I used to think the Argentine mounds were of æolian origin, but while some mounds are evidently made in this way, the explanation is not satisfactory for the great bulk of them.

Of the theories spoken of above, the ant-hill theory seems to me the most plausible, but with our present knowledge it is far from satisfactory. One other theory has been in my own mind for several years, but it is almost entirely without observations to support it, and it is, perhaps, too vague to be clearly expressed. The idea is that in soils of certain kinds long exposed to weathering agencies chemical reactions possibly take place around centers that result in the transfer of minerals in solution to and the precipitation in nuclei that are now represented by the positions of the mounds, while the withdrawal of these minerals from the intervening areas causes the depressions around the mounds. In other words, it is a theory of concretionary action on a large scale due in part to chemical and in part to physical conditions. With this theory in view I have gathered samples from beneath the hog-wallows near Fresno and others will be gathered during the coming

vacation. It is hoped that chemical analyses of these samples will throw some light on the subject.

The following references to the literature may be useful to those who wish to read what has been written regarding these mounds on the Pacific coast: Le Conte, *Proceedings California Academy of Sciences*, V., 219 (1873); *Nature*, April 19, 1877, XV., 530; Wallace, *Nature*, XV., 274; Barnes, *American Naturalist*, September, 1879, XIII., 565; Turner, 17th annual report U. S. G. S., Part I., 681. To these may be added Walther's 'Denudation in der Wüste,' 377, 390. The paper by Mr. Turner contains a good picture of the mounds on the foot-hills near Snelling, California.

J. C. Branner.

Stanford University,
March 3, 1905.

Notes on the History of Natural Science.

Oppian on Fishing.

An early work on angling, dating from the second century of our era, and possessing considerable scientific as well as literary merit, is the 'Halieutica,' in five books, by Oppian of Cilicia. Unlike most ancient writers on natural history, Oppian manifests a strict regard for truth, not only avoiding fabulous tales, but often refuting popular errors. To wide and accurate observation the author adds the charm of felicitous description, his treatment of the subject-matter being unusually graceful and animated. Concerning modes of fishing and diving, habits of marine animals and general natural history, there is much of interest to modern readers, and in former times the work was held in high esteem. Appended to the English translation, published in 1722, is a catalogue of the vernacular names of fishes mentioned by Oppian, with their common English equivalents—the latter, however, not being always accurately given. A revised *Nomenclator* of classical names of animals, with synonyms and etymology, would be gladly welcomed by modern systematists.

Roman Ichthyology.

Amongst early works of interest to ichthyologists, noticed more or less fully by Cuvier in his 'History of Natural Sciences,' there are two or three Roman writings which contain numerous and valuable observations on aquatic animals. These appeal with equal force to naturalists and classicists of our own day, though the latter appear to be on more familiar terms with them.

One of these works well worthy of attention is the '*Halieutica*' of Ovid, or commonly attributed to him, a poem which has come down to us in only one third of its entirety. Names are given in this fragment of fifty-three species of fishes, most of which are tolerably well indicated by the descriptions. Cuvier remarks that but for this poem of Ovid, a number of passages in Pliny would be unintelligible to modern readers; and in the copy belonging to the Harvard Museum, formerly the property of Louis Agassiz, occurs a manuscript note by the latter, referring to Ovid's comment on fossil shells and description of man in his '*Metamorphoses*.'

Another work regarded by Cuvier as 'extremely precious for natural history' is that bearing the assumed name of the gourmand Apicius, the ninth and tenth books being especially fruitful in information. Various ichthyological notices are contained in the agricultural works ('*De re rustica*') of Columella, Varro and Cato. Apuleius is credited with having made refined anatomical dissections, and Athenæus gives descriptions of eighty-four species of fishes, arranged in alphabetical order. It may not be generally known that Cuvier himself assisted in the recension of the text of Ælian's 'History of Animals,' his collaborators being the well-known French translators of Pliny.

Subterranean Fishes.

Lasaulx, in his 'Geology of the Greeks and Romans,' and Sir Charles Lyell, in the introductory chapter of his 'Principles of Geology,' are responsible for widespread misconception of Aristotelian views in regard to the nature and origin of fossils. Certain passages in the

works of the great Stagyrite and his successor Theophrastus, are interpreted by these authors, and in their wake by students generally, as applying to ichthyic remains found in stratified rock, whereas the original texts speak only of living fishes which burrow in the mud, and are able to survive for a considerable time out of water. Thus the passages were understood by ancient commentators, and the idea that they refer to things fossil has clearly been 'read into' them by modern historians.

Lyell's statement of the matter is as follows, omitting criticisms:

> Aristotle, in his treatise on respiration, speaks distinctly of fossil fishes; and his pupil, Theophrastus, alluding to such fishes found near Heraclea, in Pontus, and in Paphlagonia, says that they were either procreated from fish-spawn left behind in the earth, or had gone astray from rivers or from the sea, for the sake of food, into cavities of the earth, where they had become petrified.

Nothing could more completely miss the sense of the original than the above paragraph. The title of Theophrastus's essay, 'On Fishes that Exist out of Water,' is alone sufficient to exclude the notion of petrified remains. Besides, we have both ancient and modern confirmation of the accounts relative to the taking of 'dug mullets' and loaches in the same localities. Pomponius Mela, it is true, rejects the reports as improbable fish stories, but Strabo, Pliny, Polybius and others corroborate them at all points; and in our own time the facts have been verified *de novo*.

What Pliny says on this matter is interesting. He mentions a kind of loach, which Cuvier thinks is identifiable with the *Cobitis fossilis* of Linnæus, and observes that it 'frequents the waters near the banks of the rivers and makes holes for itself, in which it lives, even when the water retires and the bed of the river is dry; for which reason these fishes have to be dug out of the ground, and only show by the movement of the body that they are still alive.' Nor does he omit in the same connection ('Nat. Hist.,' IX., 83) to quote Theophrastus's statement that 'in Paphlagonia, also, land fishes are dug up which are most excellent eating.'

Strabo is equally explicit in his account of the 'dug mullets' of Narbonne, long esteemed one of the principal wonders of the Keltic coast. Thus we read in the fourth book of his 'Geography' as follows:

> There is a lake near to Ruscino [on the site of which now stands Perpignan], and a little above the sea a marshy district full of salt-springs, which supplies 'dug mullets'; for whoever digs two or three feet, and plunges a trident into the muddy water, will be sure to take the fish, which are noteworthy for their considerable size; they are nourished in the mud like eels.

It is unnecessary to prolong the discussion, or to point out that the views of ancient masters in natural science have been needlessly disparaged through faulty interpretation of the original sources. We are concerned only with restoring to the latter their literal meaning. A word may be said, however, concerning the formidable array of geological doctrines attributed by Lyell, in the work quoted, to Pythagoras, of the sixth century, B. C. Of this almost mythical personage we know very little for certain, of his doctrines nothing at all. Those ascribed to him are not Pythagorean, but Stoic; not of the hoary sixth century before our era, but Augustan; not altogether Greek, but in large part Roman; and in order to form a clear historical perspective it is necessary that these facts be recognized.

C. R. EASTMAN.
HARVARD UNIVERSITY.

SCIENTIFIC NOTES AND NEWS.

THE Central Branch of the American Society of Naturalists and affiliated societies are holding their third annual meeting at Chicago from March 31 to April 1. Professor John M. Coulter, chairman of the Central Branch, will deliver the annual address at the dinner on March 31. Special programs have been arranged for the zoologists, botanists, anatomists and physiologists. We hope to print abstracts of the papers, a considerable number of which are announced on the preliminary program.

IT is announced that the first John Fritz gold medal will be conferred upon Lord Kelvin. This medal is awarded by a joint committee of the American Institute of Electrical

Engineers, the American Society of Mechanical Engineers, The American Society of Civil Engineers and the American Institute of Mining Engineers to the man most representative of, and eminent in, scientific advance in the engineering field.

Previous to his departure for England, to assume the chair of medicine in the University of Oxford, a dinner will be given to Dr. William Osler at the Waldorf-Astoria, in New York City, on May 2.

Dr. H. P. Bowditch, professor of physiology at Harvard Medical School, has recently visited the universities of the Pacific coast.

We learn from *The Botanical Gazette* that Sir Joseph Hooker retired from the editorship of the *Botanical Magazine* at the close of 1904, after forty years of service. He is succeeded by Sir W. Thiselton-Dyer.

We learn from *Nature* that Professor W. J. Sollas, F.R.S., has been elected a member of the Athenæum Club under the rule which empowers the annual election by the committee of nine persons of distinguished eminence in science, literature, the arts, or for public services.

Professor L. C. Herdt, assistant professor of electrical engineering at McGi' University, has been awarded the honorary title of officier d'académie, by the French government.

Mr. J. E. S. Moore has been appointed director of the Cancer Research, which is carried out in connection with the Royal Infirmary.

Mr. R. R. Kelly, assistant professor in the department of engineering at the University of South Dakota, Vermillion, S. D., is resigning in order to join the staff of the Symms & Powers Company, heating and ventilating engineers, of Sioux Falls, S. D.

G. E. Coghill, Ph.D., professor of biology at Pacific University, has been elected secretary of the Oregon Academy of Sciences.

The Bakerian lecture of the Royal Society was delivered on March 23, by Dr. Horace T. Brown, F.R.S., who took as his subject 'The Reception and Utilization of Energy by the Green Leaf.'

A medal in commemoration of M. Alfred Cornu will be struck by the French Physical Society.

It is proposed to erect a memorial in Jena to Professor Ernest Abbe in commemoration of his services to optical science and industry. Subscriptions should be sent to the treasurer, Dr. Gustav Fischer, Jena.

The centenary of the birth of the Russian mathematician W. J. Buniakowsky was celebrated at St. Petersburg on December 16, and on December 29 the centenary of the birth of K. Schallbach was commemorated in Berlin.

An intercollegiate course in Appalachian Geology will be given under the direction of several instructors, as follows: July 3–8—Professor W. B. Clark, of the John Hopkins University, on 'The Tertiary and Cretaceous Strata of the Coastal Plain of Maryland.' July 10–15—Professor W. M. Davis, of Harvard University, on 'The Folded Paleozoic Strata of the Susquehanna-Juniata District of Pennsylvania.' July 17–22—Professor T. C. Hopkins, of Syracuse University, on 'The Horizontal Paleozoic Strata and Glacial Features of Central New York.' July 24–29—Professor H. P. Cushing, of Western Reserve University, on 'The Faulted Crystalline and Paleozoic Rocks of the Little Falls District, N. Y.' July 31–August 5—Professor J. Barrell, of Yale University, on 'The Metamorphic and Triassic Rocks of Western Connecticut.' This course is intended for men who have already some knowledge of general geology, including field work. The party will meet in Baltimore on Monday, July 3. The work of each week may be taken separately. It may be necessary to limit the number of members in the first week; preference will be given to those who take the entire course. A circular giving fuller details of the course can be had of Professor Clark on about March 10.

The position of chief of the Division of Chemistry, Hygienic Laboratory, Public Health and Marine Hospital Service, will be filled by civil service examination on April 26. The salary of this position is $3,200. Competitors are not assembled for examina-

tion, but will be graded for education, experience and publications. Examinations are also announced by the civil service commission on April 26–27, for forest assistants in the Bureau of Forestry, Department of Agriculture, at salaries of $1,800, $1,400 and four at $1,200; on April 12, for assistant in the Division of Biological Survey, U. S. Department of Agriculture, at a salary of $900; and on April 19, for hydrographic aids, municipal water supply, U. S. Geological Survey, at salaries of $1,000 to $1,500.

THE Fourth International Ornithological Congress, under the presidency of Dr. R. Bowdler Sharpe, of the British Museum, will be held in London from June 17 to 12 inclusive. Drs. J. A. Allen, Chas. W. Richmond and Leonhard Stejneger, and Messrs. F. M. Chapman, D. G. Elliott and Robert Ridgeway represent the United States on the general committee.

WE have received the official program of the second International Botanical Congress, which will be held at Vienna on June 11–18.

THE fifteenth German Geographentag will be held at Danzig on June 13–15.

WE learn from the *American Mathematical Journal* that the firm of J. A. Barth in Leipzig has undertaken to publish a directory, compiled by F. Strobel of Jena, of all living mathematicians, physicists, astronomers and chemists. A new edition is to appear every two years.

REPLYING to questions in the House of Commons, Mr. Brodrick, secretary of state for India, said that the latest figures on the plague in India showed that for the four weeks ending February 28 in the Bombay presidency there were 13,475 deaths, and that for the four weeks ending March 11 in the rest of India there were 123,550 deaths. The total number of deaths from the plague in the Bombay presidency from January 1 to February 28 were 28,721, and in the rest of India, from January 1 to March 11, 318,178. Mr. Brodrick said he had communicated with the viceroy of India, looking to a remedy for this deplorable loss of life, and that it had been decided to send out a scientific expedition to investigate the causes. The expedition will start immediately.

MR. ARTHUR ERWIN BROWN, secretary of the Zoological Society of Philadelphia, in a recent address before the Academy of Natural Sciences said: "The 'Origin of Species' was first published in London on November 24, 1859. On March 27, 1860, Charles Darwin was elected a correspondent of the academy. On May 8 he wrote to his life-long friend, Charles Lyell: 'This morning I got a letter from the Academy of Natural Sciences of Philadelphia announcing that I am elected a correspondent. It shows that some naturalists there do not think I am such a scientific profligate as many think me here.' It appears from the record that this academy was the first among scientific societies to confer its honors upon Charles Darwin after the publication of his immortal work."

IT was announced at the last monthly meeting of the London Zoological Society that the total number of visitors to the garden during the year 1904 had been 706,074, exceeding the numbers in 1903 by no less than 48,866. The receipts for admission at the gates during the year amounted to £17,063, being an increase of £1,151 as compared with the year 1903. The total number of fellows elected during the year had amounted to 249, showing an increase of 31 as compared with the previous year. The total number of fellows on the roll on December 31 last was 3,557, being the largest number ever recorded in the history of the society.

THE tenth International Anti-alcohol Congress is to be held at Buda-Pesth from September 12 to 16. Among the questions proposed for discussion are: The influence of alcohol on the resisting power of the human and animal organism; is alcohol a food? alcohol and sexual life; alcohol and the penal law; alcohol and physical fitness, with special reference to military training; the organization of the temperance movement; school and education in the struggle against alcoholism; the reform of the liquor trade; and the corrupting influence of the trade in spirituous liquors on the natives of Africa.

We learn from the London *Times* that the annual meeting of the Anthropological Institute of Great Britain and Ireland was held on January 21, Mr. H. Balfour, the retiring president, in the chair. The annual report of the council stated that the year had been one of steady progress, the number of new fellows and the net increase being greater than for any year since 1898. The total membership now stood at 442. The question of physical deterioration had lately been engaging public attention, and the council had prepared a memorial to Lord Londonderry recommending the organization of an anthropometric survey and the appointment of an advisory committee, and making other suggestions. An amendment to strike out of the report a proposal that the publication *Man* should be paid for by fellows in order to assist in meeting the annual deficit was rejected after prolonged discussion, and the report was approved. The treasurer's report stated that the income from subscriptions for the past year was the highest on record. Notwithstanding this highly satisfactory increase of the institute's principal source of income, there had been an excess of expenditure over income in every year of the 1900–04 period except 1902. The chief cause of these deficits appeared to have been the increase in the cost of the annual publications. The council accordingly proposed to effect economies in their publications, and to ask members to pay for their copies of *Man*. The report was agreed to. Professor W. Gowland, F.S.A., was elected president for the current year.

UNIVERSITY AND EDUCATIONAL NEWS.

According to the daily papers the articles of agreement under which it is proposed to combine the Massachusetts Institute of Technology and Harvard University have been made public. They provide for a joint school of industrial science, to be known under the present name of the Institute of Technology, to be governed by an executive board of nine members, of which three shall represent Harvard, and to be maintained by present institute funds, augmented by the income of all funds of the Lawrence Scientific School, by three-fifths of the net income which may accrue from the Gordon McKay bequest, amounting to several millions, and by the income of all property which Harvard may hereafter acquire for the promotion of instruction in industrial science. The new institute is to occupy a site on the Cambridge side of the Charles River, near the present Stadium.

The Catholic University of America will receive a bequest of $100,000 from Miss Helen Tyler Gardiner.

Mr. Andrew Carnegie has agreed to give a $50,000 library to the Washington and Lee University on condition that the university raises an endowment of $50,000 for maintaining the new library.

Two new buildings are about to be erected for the Rensselaer Polytechnic Institute. One is for the departments of mathematics and drawing and the other for the department of chemistry. Both will be strictly fire proof. Their cost will be about three hundred thousand dollars. A motion is before the Troy Common Council to make a handsome stone approach to these buildings by extending Broadway.

The board of regents of the University of Michigan at its February meeting voted to invite bids for the erection of an addition to the physical laboratory according to plans already prepared.

A bill has passed the North Dakota legislature creating a state bacteriologic and pathologic laboratory, to be located at the State University and School of Mines, and to be under the control of the university trustees and the professor of bacteriology at the university, who is to be the director.

It is announced that the Russian Ministry of Public Instruction will at once undertake the elaboration of a plan for a compulsory system of primary education. Representatives of the schools in the principal cities are invited to participate in the drawing up of the plan.

George V. N. Dearborn, Ph.D., M.D. (Columbia), has been promoted to the full professorship of physiology in the Tufts College Medical and Dental Schools.